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Main Types of HPV with High Oncogene Risk: A Systematic Review

Bruna Campagnin Luiz[1,2], Bruna Maria Carvalho[1,2], Ricardo Cervini[1,3,4], Kennyel André Velozo[1,4], Lucas Ortiz Ledur[1,4], Filipe de Matias Wagner[1], Gustavo Colombo Dal-Pont[1,4], Claudriana Locatelli[1,3,4,5], Ariana Centa[1,2,3,4,5]*

[1]*Medicine Course, Universidade Alto Vale do Rio do Peixe - UNIARP*

[2]*Academic League of Gynecology and Obstetrics (LAGO)- UNIARP*

[3]*Academic League of Oncology (LAOn)- UNIARP*

[4]*Health Translational Research Laboratory-UNIARP*

[5]*Postgraduate Program in Development and Society- UNIARP*

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***Corresponding author:** Ariana Centa, Universidade Alto Vale do Rio do Peixe - UNIARP, Caçador, Brazil

Summary

HPV (Human Papillomavirus) is the virus that causes a sexually transmitted infection, of which five of its 53 genera infect human beings and can develop cervical cancer. Among the genera, more than 200 types of HPV are still classified, 15 of which have a preference for the anogenital tract and some of them have a high carcinogenic risk, such as subtypes 16, 18, 45 and 59. The present study seeks, through a review, systematic knowledge of which HPV subtypes are the most oncogenic, and was based on the study of 122 articles found in two databases. Therefore, of the 529 articles initially selected, 169 were read in full and 122 were properly included in this review, which identified as the most oncogenic HPV subtypes described in the literature: HPV-16, HPV-18, HPV-31, HPV- 58.

Abstract

The HPV (Human Papilomavirus), is the virus that causes a sexually transmitted infection, which five of its 53 genera infect humans and can develop cervical cancer. Among the genera, more than 200 subtypes of HPV are still classified, of which 15 prefer the anogenital tract and some of them have a high carcinogenic risk, such as subtypes 16, 18, 45 and 59. The present study seeks, through a systematic review, to find out which are the most oncogenic HPV subtypes,and is based on the study of 122 articles found in two databases. Thus, of the 529 articles selected, 169 were read in the integration and 122 were properly contemplated in this review, which pointed out as the most undesirable oncogenic HPV subtypes in the literature: HPV-16, HPV-18, HPV-31, HPV-58.

Keywords: : Human Papillomavirus; HPV; High Grade Intraepithelial Lesion; Cervical Cancer; Prevalence; Genotypes.

Introduction

The Human Papillomavirus (HPV), identified as causing a sexually transmitted infection (STI), is part of the Papillomaviridae (PV) family. It is divided and cataloged into 53 genera, but only five of them are capable of infecting humans and are linked to different pathologies: alphapapillomavirus, betapapillomavirus, gammapapillomavirus, mupapillomavirus and nupapillomavirus. These five genera differ from each other by epithelial tropism. HPVs of the beta, gamma, mu, and nu genera have a cutaneous tropism causing warts on the hands or feet, while members of the alpha genus have a mucosal preference and may be associated with more serious diseases, including cancers [1]. Among the different types of HPV, 40 of them have a preference for the human genitoanal tract. Of these, 15 present a potential oncogenic risk and end up causing cervical neoplasms in 98% of cases. Therefore, the types of HPV viruses at high risk for the development of cervical cancer most described in the literature so far are: 16, 18, 33, 45, 58. Types 16 and 18 may be linked to up to 70% of cases of this neoplasm. two regarding its biological characteristics, it is known that HPV is a double-stranded, non-enveloped DNA virus with high tropism for stratified squamous (squamous) epithelium [2]. The squamous epithelium is distributed in layers and is part of the epithelial tissue, which performs the main functions of lining and secreting substances in different locations of the human body, including the vagina, allowing, after friction and mechanical forces,

replacement cell phone. Furthermore, it is known that the walls of the vagina do not have mucous glands, with mucus secreted into the vaginal lumen coming from the cervical glands of the uterus [3].

Therefore, for HPV and its tropism for epithelial cells to actually occur, one of the necessary factors described in current literature is the interaction between the virus and an unbalanced vaginal microbiota, which can lead to the development of cervical cancer [4,5]. HPV infections occur mainly sexually, requiring contact between mucous membranes. In this way, the number of sexual partners a woman has during her life can be linked to the prevalence of the pathology among this portion of the population [6]. The HPV virus reaches the epithelium through microcracks or metaplastic cells and can reach the deep layers of the cervix. After that, the virus has the ability to evade the host's immune system and remain latent for years or thrive immediately in the squamous epithelium, maturing and differentiating. Viral action causes squamous intraepithelial lesions, which can be considered pioneers in the development of a cancerous pathology [7].

Therefore, chronic infections with oncogenic types of HPV are the main risk factor for the development of cervical cancer. However, even if necessary, HPV infection in more than 99% of cases is not sufficient for the development of this type of cancer. Some factors increase the risk of neoplastic development, such as smoking, use of hormonal contraceptives, alcohol abuse and inadequate nutrition with an intake of simple carbohydrates, as well as saturated fats [8].

An important relationship is established between the development of cervical cancer and HPV infection, with this link being essential for the progression of lesions of the cervical epithelium, which precede the neoplasia itself [9]. Therefore, this neoplasia occurs due to a succession of cellular and molecular modifications preceded by contamination with HPV [10]. Furthermore, the misadjusted HPV production cycle is associated with the development of cervical cancer. Therefore, when the viral genome attaches to that of the human cell, it ends up losing genes E4 and E2, which are considered controls for the transcription of countless other viral genes, such as E6 and E7. As the function of the E2 gene decreases, there is an amplification in the genetic expression of E6 and E7, which ends up blocking the usual viral cycle [11-13].

The HPV E6 and E7 oncoproteins, considered essential for high risk, are attached to the host's genome and act with different mechanisms of action. E6 binds to the tumor suppressor protein (p53), deactivating it. At the same time, E7 acts with the pRb protein (retinoblastoma) and provides the E2F transcription factor, which will facilitate the progress of the infected cell in its cell cycle, granting it the power of immortalization. In this way, the maturation of host cells does not occur, creating tissue mutations that individualize the HPV lesions induced in their different degrees [11,14,15]. HPV, in its most oncogenic subtypes, tends to have a long incubation time, usually close to 15 years from latent infection to cancer expression [15-17]. Among the subtypes, those that are most oncogenic can be highlighted, which belong to the species alpha-9 (HPV 16, 31, 33, 35, 52, 58 and 67), alpha-5 (HPV 51), alpha-6 (HPV 53, 56 and 66) and alpha-7 (HPV 18, 39, 45, 59 and 68). Alpha-9 HPV types are persistent and more likely to progress to CIN 3 or worse. HPVs 16, 31 and 33 are associated with an increased risk of CIN 2/3 and cervical cancer. Types 52 and 58 are only associated with a higher risk of CIN 2 [18].

Epidemiologically, cancer cases are expected to increase by 81% in poor countries by 2040 due to the growing increase in socioeconomic inequality, showing that this is an important determining factor in the development of some neoplasms, including cervical cancer (CA) [19]. In this sense, cervical cancer, also called cervical cancer, is the fourth cause of mortality in women due to neoplasms in Brazil and the third most common malignancy among women [20]. Being a public health problem, this neoplasm is diagnosed in approximately 17 thousand Brazilian women annually. In 2021, the estimated risk of cervical cancer was 15.38/100,000 women [21]. Furthermore, worldwide, the pathology is considered one of the main causes of mortality among women. In 2020, 604 thousand diagnoses of cervical cancer were recorded, of which 342 thousand resulted in death [22]. The HPV vaccine is a preventive measure against persistent infection by the virus, as well as a prophylaxis of precursor lesions that could transform into malignant neoplasms. The first vaccine worldwide was approved by the US Food and Drug Administration (FDA) in 2006 [23]. In this regard, there are different vaccines in the world with coverage of more or less subtypes of HPV, including the bivalent vaccine which guarantees protection against HPV 16 and HPV 18, the quadrivalent (qHPV) which provides protection against subtypes 06, 11, 16 and 18 and also other vaccines with wider coverage such as the nonavalent which, in addition to the protection offered by the quadrivalent, encompasses subtypes 31, 33, 45, 52 and 58 [24,25].

In Brazil, the vaccine was implemented into the national vaccination calendar in 2014, free of charge through the Unified Health System (SUS). Therefore, the available vaccine is quadrivalent, recombinant and covers subtypes: 6 and 11, which are considered low risk for neoplastic lesions, and also 16 and 18, which are more frequently linked to pre-cancerous lesions. The National Immunization Program (PNI) indication is for all female adolescents aged 9 to 14 years and males aged 11 to 14 years, two doses with 6 months between applications [26]. The nonavalent vaccine is not available through the PNI, but it is approved by the National Health Surveillance Agency (ANVISA) for use in Brazilian territory and is available for sale in pharmacies. In view of the above, the research is justified given the importance of controlling cervical cancer through the adoption of public policies for the prevention and treatment of the disease. However, knowledge of the oncogenic subtypes of HPV, that is, those that have greater potential for the development of cervical cancer, is important due to the possibility of the study contributing to the implementation of preventive measures for the disease. Therefore, understanding

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the individual oncogenic risk of different types of HPV can provide basic data to evaluate the success rate of vaccination in cervical cancer prophylaxis [27]. Furthermore, the information compiled from these data can help in the analysis of potential risks, as identifying the genotypes with the highest incidence and their relationship with certain populations can contribute to studies and development of new therapeutic approaches in order to improve the prognosis and quality of life of patients diagnosed with HPV. Therefore, the article aims to develop a systematic review regarding the subtypes of the Human Papillomavirus (HPV) with greater oncological potential and relate them to the risk of developing cervical CA.

Methodology

The study aims to develop a systematic review on the types of HPV involved in the development of cervical cancer following the methodological recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Prisma). The systematic review was carried out in July 2022 with a search for scientific articles through the electronic platforms PubMed and ScienceDirect. The articles used were those published in full since 2012. The descriptors that were used in the search were ' 'High-risk Human papillomavirus'' OR "hrHPV" AND ''uterine cervical neoplasms'' OR "cervical cancer" AND "carcinogenisis" OR "carcinogenicity" OR "genotyping" OR "genotype". For the evaluation, original articles on the topic published in the electronic databases mentioned above, in the English language, and which address issues related to the objective of the study were included in vitro and animal studies, clinical trials, book chapters, theses, dissertations, conference annals, technical reports and ministerial documents were excluded.

Experimental Design

Data extraction from the selected articles took place by searching the chosen databases. Subsequently, the first selection of articles occurred with evaluation of the title and abstract, assessing whether they were, in fact, related to the review question and applying the appropriate inclusion and exclusion criteria. From this, the articles were read in full, once again applying the study criteria and the relationship with the topic addressed. The remaining articles were evaluated for quality and risk of bias according to the Quality in Prognosis Studies (QUIPS) classification criteria. The following items were evaluated: participation in the study, abandonment of the study, evaluation of the result, clarity and objectivity of the study and statistical analysis. After this classification, the articles obtained a qualification based on the following criteria: high quality (+), acceptable (+/-), low quality (-) and unsafe (?) [28].

Results

529 articles were found in the two databases selected using the methodology described above. After applying the inclusion and exclusion criteria, 57 articles remained in the ScienceDirect database and 125 in PubMed, totaling 182 articles. Of these, 13 were duplicates, leaving 169 articles for analysis. After reading the 169 articles in full, 47 were discarded as they did not address the theme proposed in this systematic review. Therefore, 122 articles were qualified for the necessary data collection as shown in Figure 1. The QUIPS instrument was used to assess the quality and risk of bias of the articles chosen for analysis. No articles were excluded from the systematic review, as none presented a high risk of bias. The main characteristics of each included article are presented in Table S1 & S2. Table 1 was created to account for those types of HPV that appeared most in the review. Thus, it was found that HPV 16 appeared in 119 articles (97.54%), followed by HPV 18 with 112 appearances (91.80%) and HPV 31 and 58, both appeared in 95 articles (77.87%). In relation to the less frequent types, HPV 70 appeared 8 times (6.56%) and the HPV 88 and HPV 89 types appeared only once (0.82%). The oncogenic HPV subtypes analyzed in the selected articles, according to the geographic location by country or region of the sample evaluated, are presented in Table 2.

Table 1: Number of articles per type of HPV.

Types of HPV	Articles	Total Articles
HPV -16	#1 to #7; #9 to #14; #16 to #26; #28 to #122	119
HPV - 18	#1; #3; #5; #9; to #13; #16 to #26; #28 to #38; #40 to #70; #72; #73; #75 to #122	112
HPV- 31	#3; #5; #7; #9 to #13; #17; #20; #21; #22; #24: #25; #28; #30; #32; #33; #34; #35; #37; #39; #40 to #44; #46; #47 to #70; #72; #74; #75; #76; #78; #79; #82 to #112; #114; #115; #116; #117; #118; #121	95
HPV -58	#two; #5; #9; #11; #14; #16; #17; #20; #21; #25; #28 to #35; #37; #39 to #44; #46 to #72; #74; #76; #78; #79; #81; #82; #83; #85 to #118; #121; #122	95
HPV - 52	#two; #7; #8; #10; #11; #13; #14; #16; #21; #24; #28; #29; #30 to #35; #37; #39; #40 to #44; #46 to #72; #74; #76; #78; #79; #81; #82; #83; #85 to #118; #121	94

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HPV - 45	#5; #9; #11; #12; #13; #19; #20; #21; #22; #28; #30 to #35; #37 to #70; #72; #76; #78; #79; #82 to #101; #103 to #107; #109 to #118; #121; #122	91
HPV -35	#8; #9; #11; #12; #14; #20; #21; #22; #28; #30 to #35; #37; #39; #40 to #44; #46; #47 to #72; #75; #78; #82 to #101; #103 to #118; #121	89
HPV -51	#4; #5; #6; #7; #9; #10; #11; #12; #20; #21; #22; #25; #28; #30 to #35; #37; #39 to #57; #59 to #70; #72; #78; #79; #82; #83; #85; #86; #88 to 118; #121; #122	89
HPV - 39	#two; #5; #7; #9; #10; #12; #13; #20; #21; #22; #28; #30 to #35; #37; #39 to #70; #72; #78; #79; #82; #83; #85; #86; #88 to #101; #103 to #118; #121; #122	88
HPV -33	#3; #10; #11; #12; #16; #19; 21; #22; #28; #29; #32; #33; #34; #37; #38; #40 to #44; #46 to #58; #60 to #70; #72; #74; #75; #76; #78; #79; #82; #83; #85; #86; #88 to 118; #121	86
HPV - 59	#4; #9; #10; #11; #12; #13; #14; #20; #22; #25; #28; #30; to #35; #37; #40 to #44; #46; #48 to #59; #61 to #64; #66 to #70; #72; #77; #78; #79; #82; #83; #85; #86; #88 to #101; #103 to #107; #109; #110; #112 to #118; #121; #122	83
HPV - 68	#5; #6; #7; #8; #10; #12; #13; #20; #21; #28; #30 to #34; #37; #40 to #52; #54 to #57; #59 to #70; #72; #77; #78; #79; #82; #83; #85; #86; #88 to #99; #101; #103; #104 to #107; #109 to #113; #115 to 118; #121; #122	81
HPV - 56	#9; #11; #12; #14; #22; #28; to #35; #39 to #57; #59 to #70; #72; #78; #79; #82; #83; #85; #86; #88; #89; #91 to #101; #103 to #107; #109 to #118; #121	80
HPV - 66	#5; #10; #20; #21; #22; #25; #27; #29; #30; #42; #43; #45 to #57; #59 to #70; #72; #78; #79; #82; #83; #88 to #95; #98; #101; #105; #106; #108; #109; #111; #114 to #118; #121; #122	63
HPV - 53	#two; #22; #27; #30; #31; #41; #42; #43; #46; #48; #49; #50; #55; #56; #59; #60 to #64; #66; #67; #68; #70; #71; #72; #78; #81; #82; #88; #92; #93; #95; #100; #108; #114; #117; #118	38
HPV - 73	#9; #27; #30; pond #33; #41; #42; #43; #forty six; #48; #50; #55; #59; #60 pond #63; #66; #sixty seven; #69; #70; #72; #88; #93; #95; #99; #107; #113; #115; #117	thirty first
HPV - 82	#9; #21; #27; thirty first; #32; #33; #40; #41; #42; #43; #45; #forty six; #48; #50; #55; #56; #59; #60; #sixty one; #62; #63; #66; #69; #70; #88; #93; #95; #99; #107; #113; #117	thirty first
HPV- 26	#27; #41; #42; #43; #forty six; #48; #50; #60; #sixty one; #63; #sixty seven; #69; #70; #88	15
HPV- 69	#3; #22; #30; #41; #42; #43; #50; #53; #70; #116; #118	11
HPV - 70	#3; #9; #27; #42; #43; #62; #70; #95	8
HPV -88	#30	1
HPV - 89	#28	1

Source: The Authors (2022).

Of the 122 articles analyzed, 46 included studies on the type of HPV in high-grade intraepithelial lesions, considering the importance of HPV infection for cervical cancer. The most frequent HR-HPV (high risk -HPV) in high-grade lesions are described in Figure 2, with HPV subtype 16 being the most found, followed by subtypes 18, 52 and 33. Furthermore, the subtype that was least found in high-grade intraepithelial lesions was HPV 45. The nonavalent type HPV vaccine encompasses protection against HPV viruses 06, 11, 16, 18, 31, 33, 45, 52 and 58. These were shown, through of this review, highly prevalent in studies. However, as shown in Figure 2, there are some types of HPV frequently present in high-grade lesions that do not have vaccination coverage, among these the most frequent are types 35 and 53. As for the quadrivalent vaccine, used in the PNI, which encompasses types 06, 11, 16 and 18 some additional virus types are left without protection, these are types 52, 33, 31, 58 and 45. In Brazil, three studies were found, number #21, #95 and #117 (Appendix 1) and included in the review. In studies carried out in the Brazilian population, subtypes 16, 18, 31, 33, 34, 39, 45, 51, 52, 58, 66, 68 and 82 appeared unanimously. Furthermore, subtypes 53, 56, 59

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and 73 were mentioned in two studies (#95 and #117). In China, 41 studies on the topic were found, totaling around 31.6% of the articles included in the review. In the Asian country, the presence of subtype 16 in the evaluations was unanimous. Subtype 18 was not verified in only 2 (4.88%) articles. Other highly prevalent subtypes, according to Chinese studies, were subtype 58 (92.68%), 33 and 52 (90.24%), 45 and 31 (85.37%) and 35 and 39 (82.93%).

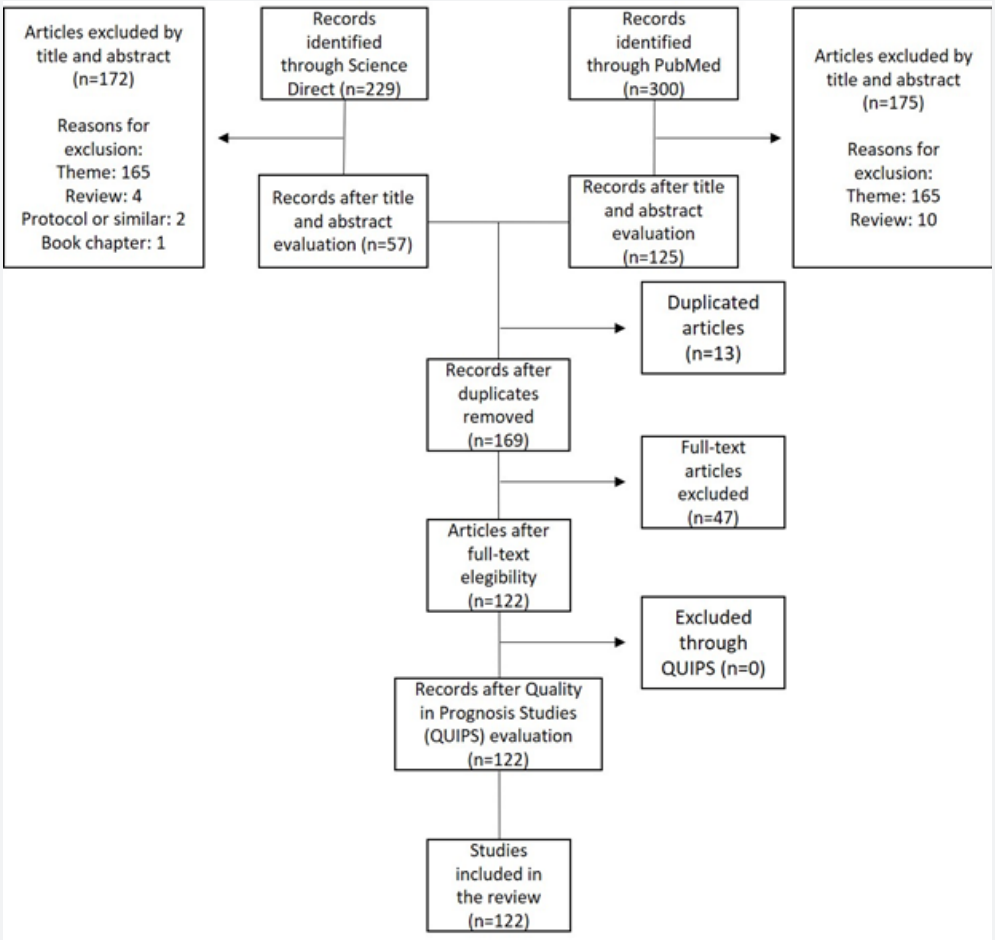

Figure 1: Flowchart of article selection for this systematic review.
Source: The Authors (2022).

Table 2: High-risk HPV subtypes by country/region.

Country	HPV subtype
China	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 73, 81, 82
US	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68
Bangladesh	16, 18, 31, 33, 69
Will	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 73, 82
Kazakhstan	16, 51, 68

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Mongolia	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 70, 73, 82
Portugal	16, 31, 39, 51, 52, 68
Zimbabwe	35, 52, 58, 68
Türkiye	16, 18, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 73, 82
India	16, 18, 31, 39, 45, 52, 56, 58, 59
Saudi Arabia	16, 18, 31, 58
Pakistan	16, 18, 33, 45
Honduras	16, 18, 31, 35, 39, 45, 51, 58, 59, 66, 68
Brazil	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 70, 73, 82
South Korea	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 69, 73, 82
France	16, 18, 26, 31, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 70, 73, 82
Australia	16, 18, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 68, 89
Sub-Saharan Africa	16, 18, 31, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 69, 73, 88
Egypt	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 73, 82
Spain	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 73, 82
Cameroon	16, 18, 33, 45
Iraq	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 69, 73, 82
Mexico	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68
Tunisia	16, 18, 26, 31, 33, 34, 35, 39, 45, 51, 52, 53, 54, 55, 56, 57, 58, 59, 66, 68, 69, 70, 73, 82
Romania	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68
Ethiopia	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 73, 82
Kenya	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68
Nigeria	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 58, 73, 82
Zimbabwe	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 69, 73, 82
Togo	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68
Martinique	16, 18, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 70, 73, 82
Botswana	16, 18
Middle East	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68
Morocco	06, 11, 16, 18, 31, 33, 35
Hungary	16, 18, 31, 33, 45, 52, 58
Nepal	16, 18, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68
Thailand	16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68, 69, 70, 73, 82
Myanmar	16, 18, 31, 33, 35, 52, 58
Japan	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68
United Arab Emirates	16, 18, 31, 33, 35, 39, 45, 51, 52, 58, 59, 66, 68
Slovenia	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68
Italy	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59
Sweden	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68
Malaysia	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 68, 73, 82
Netherlands	16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66, 68, 73

Source: The Authors (2022).

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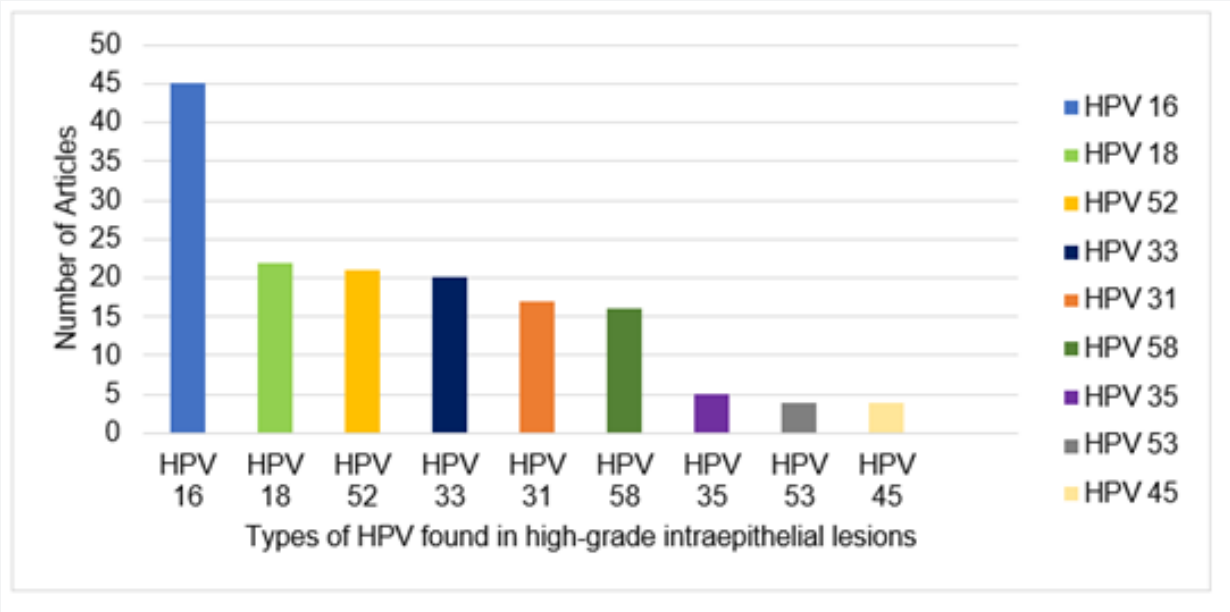

Figure 2: Most prevalent HPV types in high-grade lesions.
Source: The Authors (2022).

Discussion

HPV, in its high-risk types such as HPV-16 and HPV-18, causes neoplastic and pre-neoplastic lesions in the uterine cervix. In this sense, virus infection can be considered as an initial stage of a potentially malignant lesion, which is a major cause of mortality among women worldwide [8]. Since there are few studies in the national literature compiling the most oncogenic subtypes of HPV in Brazil, and given their strong connection with cervical neoplasia, it is extremely important to understand what these subtypes are and relate them to the most common ones in the world. As seen in the review of articles, most of the studies on the topic are from the Asian continent, 41 of them (31.6%) from China. Therefore, with the large number of studies in the Asian country, the reliability regarding the types of the virus most prevalent in that region is high. Among the Chinese studies, the one with the largest sample of patients reveals that of the 961,029 women screened, 197,367 tested positives for HPV and of these, the most prevalent high-risk oncogenic types were HPV 16, followed by 52 and 58 [29]. The same pattern is repeated in other studies where the most prevalent subtypes were HPV 16, followed by 52. Therefore, when dealing with HPV in Chinese territory, the nonavalent vaccine is effective against the main viral subtypes of HPV that pose a high risk of neoplasms in the country [30].

In this sense, despite being a source of large studies regarding the virus, the Asian country only started vaccinating against HPV in 2016 when the bivalent vaccine was approved for subtypes HPV 16 and HPV 18. The nonavalent vaccine began to be applied later, in 2018, when it was approved by the China Food and Drug Administration (CFDA) and is used in the population between 11 and 26 years old in Chinese territory. 10 Thus, it is expected that there will be a reduction in the number of HPV infections in its subtypes covered by vaccination, as well as a reduction in mortality from cervical cancer. Among the HPV types with the greatest oncogenic potential are HPV 16, 31, 33, 52 and 58. 27 In a global scenario, HPV subtype 16 is the most prevalent in high-grade lesions, generally followed by 56 and 51 [31]. This scenario coincides with studies 32 that show that in approximately 60.3% of cervical neoplasms there is the presence of HPV 16 DNA.

In Brazil this is also a reality and HPV 16 is present in around 37% of high-grade lesions and in 2/3 of patients with invasive cervical neoplasia. 31 In 70% of cases of cervical neoplasia, types 16 or 18 are present. However, subtypes 52, 31 and 58 were also found in the sample in decreasing order of prevalence. 20,31 Another study 33 shows that the most frequent high-risk HPV types in the sample were different, demonstrating that high-risk subtypes 56 and 51 are more common. Finally, a study 34 shows subtypes 16, 31, 33, 52 and 58 present in the sample studied. Thus, it is noted that the Brazilian population already has contamination by subtypes of HPV not covered by the quadrivalent vaccine, which provides protection against HPV types 06, 11, 16 and 18. Since the nonavalent vaccine, which protects against all subtypes that tetravalent has coverage and, also, against subtypes 31, 33, 45, 52 and 58, it is not available through the SUS, it appears that the Brazilian population is at risk of infection by the other types found

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in the studies and which could be avoided by integrating this new vaccine into the PNI. Furthermore, although not available free of charge to the population, the nonavalent vaccine was approved for use in the national territory by the National Health Surveillance Agency 35 and is available for purchase to the population with indications for boys and girls aged between 9 and 26 years. However, there is an important limitation to its use since the cost is high and there are few incentive campaigns that demonstrate the importance of extra coverage. Therefore, this situation shows the importance of these studies to serve as a basis for the adoption by the PNI of the nonavalent vaccine that encompasses the other carcinogenic types of HPV that live in the national territory.The relationship between the development of cervical cancer and the HPV virus is well defined as a primary scenario for improvement and progression of lesions, which are important messengers that precede cancer [9].

The lesions that precede cervical cancer have had several changes in their terminologies over the years. Therefore, cervical intraepithelial neoplasias were systematized, histologically, into 3 grades: CIN I, qualified by cellular atypia located in the lower third of the squamous epithelium, considered mild dysplasia; CIN II, where atypia is covering two thirds of the squamous epithelium, with the category of moderate dysplasia; CIN III, typifying cells that involve more than two thirds or the entire thickness area of the epithelium, indicated in marked dysplasia/carcinoma in situ [32]. Therefore, an updated cytological classification was established, the Bethesda System, which introduced numerous cytological and histological concepts and established the following classifications: CIN I, low-grade squamous lesions (LSIL); CIN II and CIN III, high-grade intraepithelial lesions (HSIL) grouped together, all related to Human Papilloma Virus (HPV) infection. As we know, each HPV genotype has a tendency to develop different lesions on the cervix. HPV types 16, 31 and 33 are associated with a higher risk of cervical cancer, while types 52 and 58 are associated with a higher risk of CIN2. 18 Therefore, it is expected that, in a population where HPV 16 is prevalent, such as the Brazilian population, we may have higher rates of neoplasms in relation to CIN2 lesions, especially if there is no adequate prevention and screening program [33].

Furthermore, it is noted that there is a trend where, regardless of the country studied, most studies have documented the presence of several of the HR-HPV subtypes. Therefore, it is inferred that the type of HPV is not only related to the location of a population itself, but shows that it is also linked to the particularities of each individual within that population [34]. Therefore, within the same population, several oncogenic subtypes of HPV are distributed. After all, it is known that HPV infection is a necessary factor, but not sufficient, for the development of cervical cancer. Other factors, mainly related to lifestyle such as smoking, prolonged use of hormonal contraceptives and diet also influence this condition [35].

When analyzing studies with larger samples from each continent, it is possible to observe the variability of HPV types that can infect the same population. In the Asian population, in 197 thousand Chinese women, subtypes 16, 52, 58, 31, 33, 45, 66, 73 and 82 were found. 29 On the European continent, with a sample of 10,665 women, subtypes 16 were observed, 39, 31, 68, 52 and 51 [36]. North America, with a sample of 15,040 Mexican women, brought subtypes 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59, 66 and 68 [37]. In South America, with a sample of 443 women, HPV types 56 and 51 are most common, followed by 53, 18, 58, 52 and 16 [38]. On the African continent, sample of 1020 women, the most prevalent subtypes were HPV 16, 18, 31, 33, 45, 53, 58. 38 Finally, in Oceania, a study with 1013 women infected by HPV, the most prevalent were 16, 51, 53, 62, 89 and 52 [39]. Therefore, it is noted that knowledge about HPV subtypes can serve as a foundation for the adoption and development of more effective prevention and therapeutic approaches to HPV infections and, consequently, reduce mortality from this neoplasm.

Conclusion

This systematic review, using appropriate search criteria, found 122 articles related to HPV subtypes at high risk for developing cervical cancer. After analyzing the articles, it is concluded that, in general, the most prevalent HR-HPV infections are HPV 16, 18, 31, 58, 52, 45, 35, 51, 39 and 33. Furthermore, it is clear that the most prevalent HR-HPV types in high-grade lesions are HPV 16, followed by HPV 18, 52, 33, 31, 58, 35, 53 and 45. Therefore, it is inferred that studies on the types of HPV that are most related to cervical neoplasms are of paramount epidemiological importance for public health policies, especially vaccines that protect a population against the main types found in their region.

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Table S1: The main characteristics of each included article are presented.

No. _	Ref	Country	HPV Types	Population/Sample (Quantity – Age)	Methodology	Main Results
1.	Rufail, Et Al., 2020	USA	HPV – 16 HPV – 18	Women - 526 Age – 25 to 65 years Time – 2 years	Retrospectivsse Review	HSIL: including 19 (17%) patients aged 25 to 29 years and 50 (19%) patients aged 30 to 65 years. No cases of invasive carcinoma were identified. When 2 or more hr HPV subtypes were present, 11 of 24 (46%) had HSIL on biopssdssy. The result of hr HPV was more common among patients between Ages 25 and 29 than patients between 30 and 65 years old. The risk of invasive carcinoma is higher with HPV16 infection.
2.	Tao, Et Al., 2021	China	HPV – 52 HPV – 16 HPV – 58 HPV – 53 HPV – 39	Women – 124,151 Age – 16 to 94 years old Time - October 2017 to February 2020	Case study	The total HPV-positive rate in these 124,251 women was 24.3%. A rate of 22.9% (28,397 of 124,251) positive for HR-HPV. HR-HPV was detected in 72.7% of women aged 30 to 49 years and 41.4% of women aged 50 years. Overall, the 5 most common subtypes of HR-HPV in our study population were HPV 52 (6.1%), followed by HPV 16 (4.1%), HPV 58 (3.6%), HPV 53 (3.3%) and HPV 39 (2.2%). HPV 16 has been associated with a higher risk of abnormal Pap smears and HSIL. Vaccine coverage in the studied population (HPV 16 and 18), which are included by all current vaccines, was present in 4.8% of the studied population.
3.	Sharmin, Et Al., 2021	Bangladesh	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 69 HPV-70	Women – 410 Age – 14 to 70 years Time - February 2015 to June 2018	Prevalence Study	Positive HPV test results were obtained for 121 individuals, a prevalence of HPV infection of 41.86%. 75 were positive for a HPV subtype, responsible for 61.98% of HPV infections. 46 individuals were positive for various HPV subtypes, representing 38.01% of HPV infections. HPV-16 and 18 subtypes are the most commonly found worldwide, while subtypes HPV-33, 45, 52 and 58 are more prevalent in Asia than anywhere else in the world. In our study, the prevalence of high risk the subtypes were HPV-16, 18 and the combination of HPV-16 and 18. HPV's in Bangladesh should focus on HPV-33, 31, 69 and 70, in addition to HPV-16 and 18.
4.	Ye, Et Al., 2015	USA	HPV – 16 HPV – 51 HPV – 59	Women – 593 Age – X Time - X	Prevalence Study	HGSIL had the highest percentage of samples positive for hrHPV . hrHPV genotypes was HPV59 at 18.6%, followed by HPV16 at 12.8% and HPV51 at 10.1%.

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5.	Bitarafan, Et Al., 2021	Iran	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 39 HPV – 45 HPV – 51 HPV – 58 HPV – 66 HPV-68	Women – 12,076 Age – 18 to 71 years old Time - 2 years (November 2016 to November 2018)	Cross-sectional study	Single infection (2,681 cases, 57.4%) was the most common form among participants. Patients with double infection, 450 (9.63%). Patients with triple infection, 197 (4.22%). Ten common HR-HPV genogenoses types were as follows: HPV 16 (552, 16.98%), HPV 52 (286, 8.8%), HPV 18 (250, 7.69%), HPV 39 (248, 7.63%), HPV 31 (242, 7.45%), HPV 51 (213, 6.55%), HPV 45 (183, 5.63%), HPV 68 (180, 5.54%), HPV 66 (171, 5. 26%) and HPV 58 (157, 4.83%). HPV 16 was the most high-risk genotype among all participants. HPV 26 was the least common.
6.	Babi, Et Al., 2021	Kazakhstan	HPV – 16 HPV – 51 HPV – 68	Women – 809 Age – 18 to 70 years old Time - May 25, 2019 to December 30, 2020	Prospective Cross-Sectional Study	In the sample population, 61% did not have HR-HPV infection. 26% had a single HR-HPV infection. 13% had multiple infection (2 or more HR-HPV types detected). Of all cases of single infection, HPV-16 had a prevalence of 54%, followed by HPV-68 and HPV-51, both 7%,
7.	Sousa, Et Al., 2019	Portugal	HPV – 16 HPV – 31 HPV – 39 HPV – 51 HPV – 52 HPV – 68	Women – 105,458 Age – 25 to 60 years Time - August 2016 to December 2017	Prevalence Study	10,665 (10.2%) were HR-HPV positive, with multiple infections (by two or more HR- HPVs) being detected in 25.7%. Within HR-HPV positive women, the most common genotypes found in the population were HPV-16 (17.5%), HPV-39 (16.7%), HPV-31 (15.0%), HPV-68 (13.2%), HPV-52 (10.7%) and HPV-51 (10.6%). The distribution of the HR-HPV genotype according to age revealed that HPV- 16 predominated in women aged 30, 35, 40 and 45 years. HPV genotypes (HPV-16, -39, -31 and -68) were the same in all geographic locations. The HPV genotypes present in the new-valent vaccine (HPV16/18/31/33/45/52/58) represent 47.6% of all positive cases, varying from 40.9% to 53.7% depending on with age and from 42.7% to 48.1% according to geographic location.
8.	Fitzpatrick, Et Al., 2019	Zimbabwe	HPV-35 HPV-52 HPV-58 HPV-68	Women – 957 Age – 30 to 65 years Time – January 17th to May 17th, 2017	Cross-sectional study	Among women with complete survey and hrHPV data , the prevalence of hrHPV was 17.4%. The prevalence of hrHPV was 19% (51/265) among women <40 years old, 18% (30/167) among women aged 40 to 50 years, and 13% (22/167).
9.	Tsedenbal, Et Al., 2018	Mongolia	HPV – 16 HPV – 18 HPV – 31 HPV-33 HPV – 35 HPV-39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 70 HPV – 73 HPV – 82	Women – 100 Age – 18 to 65 years old Weather – March to May 2017	Cross-sectional study	7% of women had HSIL. Overall, HPV DNA was detected in 47% (47/100) of participants, of whom 32% were infected with single HPV infections and 68% were infected with multiple HPV infections. The most prevalent HR-HPV types were 16 (21%, 21/100), 52 (14%, 14/100), 58 (6%, 6/100), 33 (6%, 6/100), 31 (5%, 5/100). The present study also found HPV 16, 52, 58, 33 and 31 as the dominant types of HR-HPV. The current study revealed a high prevalence of HPV 52 and low prevalence of HPV 18 among women

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10.	Demerci Et Al., 2018	Türkiye	HPV – 16 HPV-18 HPV-31 HPV-33 HPV – 39 HPV – 51 HPV-52 HPV – 59 HPV – 66 HPV-68	Women – 2464 Time - Age – 20 to 80	Prevalence Study	HPV genotyping testing showed that 649 of 2,464 patients (26.3%) were positive. HPV positivity was more frequently found generally in the age range of 30 to 39 years. Among 649 positive patients, 223 (34.3%) were found positive for more of a genotype. The most common HR-HPV genotype was 16 followed by 52 and 31.
11.	Sabet, Et Al., 2021	Iran	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59	Women – 567 Age – 15 to 56 years Time - March 2013 to July 2018	Prevalence Study	HPV was the most prevalent in the 26 to 35 age group. The overall prevalence of HPV and HR-HPV was 28.9% and 20.4%. The most prevalent HR-HPV genotypes are 16 and 59.
12.	Yuanyue, Et Al., 2018	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 56 HPV – 59 HPV – 68	Women – 511 Age – 21 to 86 years old Weather - November 2012 and December 2015	Prevalence Study	Prevalence of HPV DNA was 77.3%, 56.9% being single infections and 20.3% infection by multiple genotypes. Genotyping based on the HPV L1 gene results revealed 23 genotypes, including 13 HR-HPV (HPV-16, 52, 58, 18, 31, 33, 35, 39, 45, 51, 56, 59 and 68).
13.	Negi, Et Al., 2019	India	HPV – 16 HPV – 18 HPV – 31 HPV – 39 HPV – 45 HPV – 52 HPV – 59 HPV-68	Women – 185 Age – 21 to 65 years old Time – September 1, 2017 to September 3, 2018	Prevalence Study	In invasive carcinoma, HPV 16 was found as the sole etiological agent in 9 cases of SCC and 3 cases of AC in in addition to its presence also found in co-infection with one or more genotypes. The second most predominant HPV genotype detected in SCC was HPV 18 with a prevalence of 28.5%.
14.	Stoler, Et Al., 2019	Usa	HPV – 16 HPV – 35 HPV – 52 HPV – 56 HPV – 59 HPV – 58	Women – 33,858 Age – 25 years or older Time – 3 years	Longitudinal Prevalence Study	HPV 16, HPV 52, 35/59/68 and 56/59/68 were the four genotyping results.
15.	Zhong, Et Al., 2017	China				
16.	Obeid, Et Al., 2020	China	HPV – 16 HPV – 18 HPV – 33 HPV – 52 HPV – 58	Women – 71,435 Age – 16 to 77 years old Time - August 1, 2010 and December 31, 2015.	Prevalence Study	Positive HPV test results were obtained for 16,065. Among HPV-positive women, 10,711 were positive for a single HPV subtype, representing 66.67% of HPV infections and 14.99% of all samples; 5354 were positive for various HPV subtypes. 2.70% of all samples; 8785 were high-risk HPV subtypes. The high-risk subtypes were HPV-16, -18, -33, -52 and -58.
17.	Gul, Murad, Javed, 2015.	Saudi Arabia	HPV – 16 HPV – 18 HPV – 31 HPV – 58	Women - 933 Age – 11 to 95 years	Prevalence Study	In general, higher viral load in both HPV-16 and HPV-18 was found predominantly in specimens who have had cervical cancer or HGSIL. The highest viral loads were mainly found in single HPV 16 or HPV 18 infections.

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18.	Aziz, Et Al., 2018	Pakistan	HPV – 16 HPV – 18	Women – 67 Time – 3 years	Prevalence Study	Paraffin-embedded biopsies were screened for high-risk HPV types 16 and 18 with the help of PCR. HPV type 16 was detected in 44.8% (30) of cervical cancer biopsies, while 32.8% (22) of cervical samples were positive for HPV 18.
19.	Atkinson, Et Al., 2018	Pakistan	HPV – 16 HPV-18 HPV – 33 HPV-45	Women – 1011 Age – 18 to 82 years old Time - March 2014 to January 2016	Prevalence Study	Forty-eight samples were considered positive for HPV DNA. HR-HPV was 31.25% (15/48). HR-HPV types 45 (6/48, 12.5%), 33 (4/48, 8.33%), 18 (3/48, 6.25%), and 16 (2/48, 4.17%).
20.	Cordel, Et Al., 2015	Honduras	HPV – 16 HPV – 18 HPV – 31 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 58 HPV – 59 HPV – 66 HPV-68	Women – 111	Prevalence Study	27 samples (24%) positive for hrHPV infection . In total, 35% of the population examined had at least one HPV infection. Through melting curve analysis, 12 different high-risk genotypes were identified in the population: HPV-52 (29%), HPV-16 (23%), HPV-39 (10%), HPV-68 (6%) , HPV-58 (6%), HPV-45 (6%), HPV-51 (3%), HPV-31 (3%), HPV-18 (3%), HPV-66 (3%), HPV -59 (3%), HPV-35 (3%).
21.	Paesi, Et Al., 2015	Brazil	HPV – 16 HPV-18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV-45 HPV – 51 HPV – 52 HPV – 58 HPV – 66 HPV – 68 HPV – 82	Women – 250 Age – 20 to 60 years Time – January 1, 2010 to September 30, 2011	Retrospective Cross-Sectional Study	ASCUS was recorded for 25 (10.0%) women. The highest prevalence of ASCUS was recorded among women 35–44 years old. Among the 225 women without ASCUS, 70 (31.1%) had LSILs, 8 (3.6%) had HSILs, 133 (59.1%) had cytological inflammation, and 2 (0.9%) had carcinoma. High-risk genotypes (HPV16, HPV18, HPV31, HPV33, HPV35, HPV39, HPV45, HPV51, HPV52, HPV56, HPV58, HPV66, HPV68 and HPV82).
22.	Wang, Et Al., 2015	South Korea	HPV – 16 HPV-18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 53 HPV – 56 HPV – 56 HPV – 59 HPV – 66 HPV – 68 HPV-69	Women – 630 Age – 17 to 90 years old Time - June 2011 to July 2013	Prevalence Study	Among 630 cytology samples, 259 were confirmed histologically using biopsy or excision samples. Of these, 45 cases were identified as SCC, 72 as high-grade HSIL. HR-HPV genotypes were grouped as set 1 (HPV 16, 31, 33, 35, 52 and 58), set 2 (HPV 18, 39, 45, 51, 59, and 68) and set 3 (HPV 53, 56, 66 and 69). The HR-HPV group at all ages was defined as 1 (overall prevalence 59.5%), followed by cluster 3 (24.2%) and cluster 2 (16.4%).
23.	Abu-Lubad, Et Al., 2020	USA	HPV – 16 HPV – 18	Women – 144 Age – 50 years old (average age). Time - 2015 to 2017	Observational Study	Distribution of HPV16 and HPV18 in different age groups among cases with endometrial carcinoma revealed that HPV16 was not detected in both groups, while HPV18 was detected in 3/5 (60%) of HPV-positive cases with endometrial carcinoma and in 5/17 (29.4%) among HPV controls. Mixed HPV16 and 18 infections

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24.	Monsonego, Et Al., 2020	USA	HPV – 16 HPV – 18 HPV – 31 HPV – 52	Women – 47,208 Age – 25 years or older Time - May 2008 and August 2009	Prevalence Study	HPV16 was the most prevalent genotype across all age groups, ranging from 3.5% to 0.8% in women aged 25–29 and ≥50 years, respectively. The next most prevalent genotypes were HPV52, HPV31 and HPV18. In the general population, HPV16 conferred the highest absolute risk of ≥CIN3 in both women aged 25-29 and ≥30 years (14.2% and 15.1%, respectively) followed by HPV31 (8.0% and 7.9%), HPV52 (6.7% and 4.4%), and HPV18 (2.7% and 9.0%).
25.	Martora, Et Al., 2019	France	HPV – 16 HPC – 18 HPV – 31 HPV – 51 HPV – 58 HPV – 59 HPV – 66	Women – 1265 Age – 16 to 63 years old Time - January 2011 to December 2017	Prevalence Study	563 (44.5%) were positive for HPV DNA. HPV-positive patients, 266 (47.2%) (95% CI 43.12–51.37) were infected with a single type (ST) of HPV, 297 (52.8%) (95% CI 48.63–56.88) with multiple infection (MT) and 395 (70.1%) (95% CI 66.38–73.94) with ≥1 HR-HPV type. The most prevalent HR-HPV genotypes were HPV-16 (23.8%), HPV-31 (12.1%), HPV-66 (8%), HPV-59 (7.6%), HPV-51 and HPV-58 (both 7.4), HPV-18 (6.9%). the distribution of both HR (64.6%) and the LR genotypes (59.2%) always showed the highest prevalence in age group < 23 years, compared to 23–29 years 60.5% for HR-HPV.
26.	Zang, Et Al., 2014	USA	HPV – 16 HPV-18	Women – 2653 Age – 16 and 54 years old Time - May 2006 to April 2007	Cross-sectional study	Positive rates of 13 HR-HPV. For HR-HPV types, the positive rate was greater than 95% in women with CIN2+, regardless of the anatomical location of the samples. HPV 16/18 was approximately 70–80% in women with CIN2+, 20–30% in women with CIN1, and 10–20% in women with histology.
27.	Molet, Et Al., 2019	France	HPV – 26 HPV – 53 HPV – 66 HPV – 70 HPV – 73 HPV – 82	Women – 252	Prevalence Study	Among the 54 sequencing samples, 16 different types were detected, HPV83 (21/54) and HPV42 (20/54) were the most frequently detected, followed by HPV81, HPV67, HPV90, HPV74 and HPV87. HR-HPV (26, 53, 66, 70, 73 and 82).
28.	Tabrizi, Et Al., 2014	Australia	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 89	Women – 2620 Age – 18 to 60 years old Time - April 2005 and February 2008	Prevalence Study	Of the 2,557 women with results, 239 (9.3%) initial low-grade/ low-grade abnormality (LGA) and 47 (1.8%) possible or definite high-grade abnormality (HGA), including a squamous cell cancer . Positive DNA samples were genotyped , including 691 (68.2%) with an HR genotype. The prevalence of infection with any HPV was 38.7% (1013/2620) and with HR-HPV it was 26.4% (691/2620). The six most common genotypes were: HPV 16 (8.3%), 51 (5.1%), 53 (4.7%), 62 (4.3%), 89 (3.9%) and 52 (3.8%), the prevalence of HR-HPV.
29.	Li-Hua, Et Al., 2014	China	HPV – 16 HPV – 18 HPV – 33 HPV – 52 HPV – 56 HPV – 58 HPV-66	Women – 4,899 Age – 16 to 59 years old Time - September 2009 to August 2013	Prevalence Study	For all 3,288 cases, there were 2,038 cases with a single HPV type infection and the incidence rate was 31.32%, and multiple infection of the HPV type (1,250 cases and the incidence rate was 19.21%). Of the HR-HPV types, HPV16, 52, 58, 56, 18, 66 and 33 were common, whose incidence rates were 6.31%, 5.06%, 4.04%, 2.60%, 2 .41%, 2.40% and 2.28%.

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30.	Catarino, Et Al., 2016	Sub-Saharan Africa	HPV – 16 HPV – 18 HPV – 31 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 69 HPV – 73 HPV – 88	Women – 1081 Age – 30 to 65 years Time - between 2013 and 2015	Prevalence Study	The prevalence of HPV was analyzed in 1,020 women. The overall prevalence of HPV was 39.3% (401/1020) for all 19 high-risk types. Overall, 25.8% of CIN2+ cases were associated with HPV-16/18, and 26.0% of CIN2+ cases included HPV-53, HPV-69, or HPV-73. The proportion of CIN2+ containing each genotype was highest for HPV-16 (17.3%), followed by HPV-18, HPV-31, HPV-33, HPV-35, HPV-53 and HPV-58 (13.0% each). HPV-26 and -82 were not associated with CIN2+.
31.	Tamalet, Et Al., 2016.	France	HPV-16 HPV-18 HPV-52 HPV – 66 HPV-51 HPV-31 HPV-39 HPV-56 HPV-53 HPV - 35 HPV-59 HPV-45 HPV-68 HPV-58 HPV-82 HPV-73	Age – 35-69 years Women - 4236	Cross-sectional study HPV screening was performed on 4,236 self-collected samples using the Abbott RealTime High Risk HPV test according to the manufacturer's instructions. This real-time PCR-based assay allowed individual genotyping for HPV16 and HPV18 and joint detection of 12HR-HPV genotypes: HPV31, HPV33, HPV35, HPV39, HPV45, HPV 51, HPV52, HPV56, HPV58, HPV59, HPV66 and HPV68	114 (18.7%) positive for HPV16 (102 single infections and 12 co-infections), 41 (6.7%) positive for HPV18 (36 single infections and 5 co-infections) the most frequently encountered HR-HPV types were HPV52 (35%), 66 (22.6%), 51 (19.6%), 31 (15.7%), 39 (13%), 56 (10.4%), 53 (9.2%), 35 (8.4%), 59 (6.6%), 45 (4.5%), 68 (4.5%), 58 (3 ,7),
32.	Paz-Zulueta, Et Al., 2014	Spain	HPV – 16 HPV - 18 HPV - 31 HPV – 33 HPV - 35 HPV - 39 HPV - 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 73 HPV -82	Age - 21 and 65 years old Women - 3832 Final samples - 3359	Cross-sectional descriptive study of the results of Early Cervical Cancer screening using simple random sampling	Genotype 16 was the most common (28.89%). Genotypes 16 and/or 18 were detected in 34.45% of women. More than half of the women were positive for genotype 51 (18.89%) or 58 (13.33%) or 68 (12.22%) or 31 (11.11%) or 45 (3.33%)

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33.	Shaltout, Et Al., 2014	Egypt	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV-51 HPV – 52 HPV - 56 HPV – 58 HPV – 59 HPV – 68 HPV – 73 HPV – 82	Women - 443 Age – over 18 years old	This multicenter observational study was carried out in two hospitals (Al Kasr Al Aini University Hospital, Cairo, and Ain Shams University Hospital, Cairo) and an outpatient clinic (Alexandria University Hospital, Alexandria) between October 2010 and August 2011	HPV-16, 31 and 51 were the most prevalent HR HPV types and HPV-62, 84 and 6 were the most prevalent LR HPV types In contrast to global estimates that HPV-16 and 18 are responsible for almost 70% of cervical cancer cases,6 our study showed a relatively low prevalence (0.7%) of HPV-18 in Egyptian women
34.	Li, Et Al., 2016	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women - 19,018	Cross-sectional study A total of 19,018 outpatient specimens from the obstetrics and gynecology department were collected. They were detected using the high-risk HPV genotyping real-time polymerase chain reaction (PCR) kit and analyzed by the Thin-Prep cytology test for cervical pathological diagnosis. HPV prevalence, age-specific prevalence, and OR of each HPV type on abnormal cytology	HPV52 had the highest prevalence (4.4%, 834/19,018), followed by HPV16 (3.7%, 710/19,018), HPV58 (3.4%, 644/19,018), HPV39 (2.7%, 518/19,018) and HPV51 (2.0%, 387/19,018). HPV18 had a prevalence of 1.3% (241/19,018) and ranked seventh. In the 2,833 patients infected with a single infection, the three most prevalent types were HPV52 (3.0%, 576/19,018), HPV16 (2.6%, 491/19,018) and HPV58 (2.2%, 416/19,018) . In the 790 patients infected with multiple infections, the three most prevalent types were HPV52 (1.4%, 258/19,018), HPV39 (1.3%, 253/19,018) and HPV58 (1.2%, 228/19,018) . HPV52 had the highest prevalence (4.4%), followed by HPV16 (3.7%) and HPV58 (3.4%), while HPV18 (1.3%) came in seventh place. Previous studies suggested that HPV52 and HPV58 are two important HPV types associated with CC in China. The result of oncogenic HPV prevalence in the current study was consistent with those from previous studies
35.	Castellsagué, Et Al., 2020	Asia, North America, Europe, Latin America, Oceania	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 45 HPV – 52 HPV – 58 HPV – 35 HPV – 39 HPV – 51 HPV – 56 HPV – 59	Age - 15 to 26 years and 24 to 45 years Time – 4 years Women - 10,706	Clinical trial Analyzes of the prevalence of the 14 types of HPV tested in cervical lesions (defined as biopsy or excisional surgical specimen) were performed on 10,706 women randomized to the placebo arms of the trials (representing over 99% of the total number randomized to the placebo arms)	The most common HPV type detected in young women (15 to 26 years) in any region was generally HPV16, followed by HPV56 and 51, while in older women (24 to 45 years), HPV56 infection was most common, followed by HPV51 and HPV51. 52. However, in Asia, HPV52 had the highest prevalence in both age groups. The predominant HPV types were 16/51/52/56 (anogenital infection), 16/39/51/52/56 (CIN1) and 16/31/52/58 (CIN2/3). In regions with larger sample sizes, minimal regional variation in type 9vHPV prevalence was observed in CIN1 (-50%) and CIN2/3 (81–85%). Types 31/33/45/52/58 represented 25–30% of CIN1 in Latin America and Europe, but 14–18% in North America and Asia. Types 31/33/45/52/58 represented 33–38% of CIN2/3 in Latin America (younger women), Europe and Asia, but 17–18% of CIN2/3 in Latin America (older women) and North America. Non-vaccine HPV types 35/39/51/56/59 had similar or higher prevalence than qHPV types in CIN1 and were attributed to 2-11% of CIN2/3 The 9vHPV vaccine could prevent most CIN1-3 regardless of geographic region. Nevertheless, non-vaccine types 35/39/51/56/59 may still be responsible for some CIN1 and, to a lesser extent, CIN2/3.

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36.	Siddiqa, Et Al., 2014	Pakistan	HPV – 16 HPV -18	Women - 74 Age – 25 to 70 years	Cross-sectional study In this study, detection and genotyping of HPV types 16 and 18 were carried out in 77 cervical specimens The present study was carried out using retrospective paraffin-embedded cervical cancer tissues from patients from different areas of Punjab, Pakistan in order to determine the prevalence of HPV infection in cervical cancer samples and the relevant HPV genotypes associated with the disease . .	19 samples (24.68%) were positive only for HPV type 16 20 samples (25.97%) were positive only for HPV type 18 31 samples (40.26%) showed detectable co-infection with HPV16 and 18
37.	Zhao, Et Al., 2017	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV - 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women - 1274 Age - 35 to 45 years	Statistical analysis Cross-sectional study	The most frequently detected genotypes in HR-HPV-positive grade 1 cervical intraepithelial neoplasia (CIN1) were HPV52 (24.1%), HPV31 (20.7%), HPV16 (13.8%), HPV33 (13.8%), HPV39 (10.3%), and HPV56 (10.3%); in HR-HPV-positive cervical intraepithelial neoplasia grade 2 or worse (CIN2+): HPV16 (53.1%), HPV58 (15.6%), HPV33 (12.5%), HPV51 (9.4%) and HPV52 (6.3%). HPV52, 31, 16, 33, 39 and 56 together contributed to 89.7% of HR-HPV-positive CIN1 and HPV16, 33, 58, 51 and 52 together contributed to 87.5% of CIN2+ In 194 women (15.2%, 194/1,274) with positive results for HR-HPV, HPV16 (19.1%), 52 (16.5%), 58 (16.5%), 33 (13.4 %) and 56 (11.9%) were the most common genotypes. The prevalence of HRHPV in normal pathology, CIN1 and CIN2+ was 11.1% (133/1,199), 72.5% (29/40) and 91.4% (32/35), respectively. The prevalence of HR-HPV is positively correlated with the severity of neck injury The most frequent HPV genotypes identified in our study population were 16, 52 and 58
38.	Simo Et Al., 2021	Cameroon	HPV – 16 HPV – 18 HPV – 33 HPV – 45	Women – 616 Age – 20 years and over	Cross-sectional study A cross-sectional study targeting HPV-positive women aged 20 or over was carried out between March and June 202	HPV 16 infections represented 58.39% (with 51.25% of coinfections), HPV 18 represented 46.71% (62.50% of coinfections), HPV 33 represented 27.01% (62.16% of coinfections) and HPV 45, 12.41% (58.82% of co-infections) The HPV types tested were detected in 137 participants, of which 38.7% had multiple HPV infections, and the remainder had single HPV infections of type HPV 16 (28.5%), HPV 18 (17.5%) , HPV 33 (10.2 %) and HPV 45 (5.1%) Co-infections with HPV 16 and HPV 18 were significantly associated with HSIL (p=0.001), while HPV 45 was more common in participants with normal cytology

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39.	Alacam, Bakir., 2021	Türkiye	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women – 2,285 Age – 17 to 76 years	Retrospective, Descriptive and Cross-Sectional Study	Of women infected with HR-HPV, 30.9% (256/829) were infected with HPV16, 14.6% (121/829) with HPV39, and 14.2% (118/829) with HPV51. HPV18 was detected in 9.9% (82/829) of women. The most common HR-HPV genotypes detected in Turkish women are HPV16 (30.8%, 247/803), HPV39 (14.7%, 118/803), HPV31 (13.9%, 112/803) and HPV51 (13.9%, 112/803)) and in foreign women were HPV16 (34.9%, 9/26), HPV51 (23.1%, 6/26), HPV56 (19.2%, 5/26) and HPV39 (11.5%, 3/26), respectively. HPV was positive in 36.3% (829/2,285) of DNA samples. The prevalence of multiple HR-HPV infection was 40.7%. Of the women, 30.9% (256/829) were infected with HPV16, 14.6% (121/829) with HPV39 and 14.2% (118/829) with HPV51. The most frequently detected genotypes with HPV16 were HPV31, HPV39 and HPV52, respectively. In women with cervical dysplasia, HPV16, 31, and 39 were the most common, and in women with genital warts, HPV16, 59, and 66 were the most common, respectively. The highest prevalence of HR-HPV was detected in the age group of 17 to 34 years (44.1%) ($p < 0.001$).
40.	Li, Et Al., 2020	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 82	Women - 3,089 Age – 29 years or older	Retrospective cohort study	The 4 most frequent HR-HPV genotypes among HPV-positive women were HPV52 (26.1%, 188/720), followed by HPV58 (19.7%, 142/720), HPV16 (18.9%, 136/ 720) and HPV51 (10.8%, 78/720), collectively The most detected HPV genotype was HPV52, followed by HPV58, HPV16 and HPV51
41.	Pity, Abdo, Goreal ., 2019	Iraq	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 69 HPV – 73 HPV – 82	Women - 64 Age – 17 to 60 years old	Cross-sectional study	The high-risk group comprised 6 HPV16, 4 HPV18, 2 HPV66, 2 HPV52, 2 HPV39, 1 HPV56, 1 HPV31 and 1 HPV45. The 16 low-risk strains included 4 strains of HPV6, 4 HPV71, 2 HPV54 and 2 HPV83, HPV11, HPV61, HPV84 and HPV 62. Mixed infections were described in 4 women (6.25%), limited to NILM, ASC-US and LSIL smears. They included variable mixtures of 7 high-risk genotypes, HPV39 (both copies), HPV66 (both copies), HPV52, HPV31, HPV45, and 6 low-risk strains: HPV83, HPV6, HPV11, HPV54, HPV62, and HPV71 .
42.	Juárez-González, Et Al., 2020.	Mexico	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 69 HPV – 73 HPV – 82	Women - 421 Age – 15 to 85 years	Analytical Cross-Sectional Study	91.6% of samples were positive for hrHPV . The prevalent HPV types were 16, 66, 52 and 51. The most prevalent hrHPVs were types 16 (45.4%), 66 (35.5%), 52 (33.7%) and 51 (33.3 %). HPV 18 was found in only 10.3% of the samples. The viral types with the lowest prevalence were types 68, 35 and 33 (1.4%, 1.1% and 0.7%, respectively)

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43.	Bel Haj Rhouma, Et Al., 2021	Tunisia	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV-66 HPV-68 HPV-69 HPV – 70 HPV-73 HPV-82	Mulheres - 200 Age - 19 a 59 anos	Estudo Retrospective Women with cervical intraepithelial neoplasia diagnosed on biopsies	The distribution of HR-HPV according to the grade of the lesion and cervical cancer showed that HPV16 and HPV18 were present in all lesions. For CINII/CINIII, HPV 35 (37.5%) was the most detected type, followed by HPV18 (33.3%), HPV 45 (28.5%) and HPV 16 (18.9%). HPV 45 (57.5%), HPV 18 (53.3%) were the most detected in CC. HPV58, 59, 68 were detected only in CC and associated with HPV45, 18 and HPV16. HPV39, 31, 33, 52, 56 and HPV70 were associated only with CIN The most prevalent LR-HPV type was HPV 6 followed by HPV11, 42, 40, 43 and HPV 54. The predominant HR-HPV were HPV 16, 18, 53, 35, 45, 39, 51, 52, 33, 59 , 68, 70, 66 and HPV 56
44.	Plesa, Et Al., 2019	Romania	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Age - 17 to 58 years Women - 611	Prevalence Study	Low, medium or indeterminate HPV genotypes were found in 31 cases: HPV 11 (n = 10; 8.26%), HPV 66 (n = 9; 7.38%), HPV 6 (n = 9; 7.38 %) and HPV 63 (n = 5; 4.13%). On the other hand, hrHPVs were identified in 90 women (14.73% of all cases, 74.38% of HPV positives). HPV 16 was the most common oncogenic type (n = 30; 24.79% of all HPV-positive samples) with a frequency of 17.54%. Other hrHPV were HPV 33, HPV 51 (n = 8; 6.61% each), HPV 18 (n = 7; 5.78%) and HPV 31 (n = 6; 4.95%).
45.	Yu, Et Al., 2021	China	HPV – 16 HPV – 18 HPV – 39 HPV – 45 HPV – 56 HPV – 59 HPV – 66 HPV – 68 HPV – 82	Women - 29,436 Age - 18 years and over	Retrospective Cross-Sectional Study	The most prevalent genotypes were HPV52, 58, 16, 51 and 56. Furthermore, while infection with a single genotype (9.84%) was more prevalent, HPV16+52 was the most common combination in those infected with multiple HPVs. The most prevalent genotypes were HPV52, with a frequency of 3.04% (895/29,436), followed by HPV58, 16, 51 and 56, with a frequency of 1.84% (541/29,436), 1.82% (535/ 29,436), 1.18% (346/29,436) and 1.06% (311/29,436), respectively
46.	Teka, Et Al., 2021	Ethiopia	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Age – 30 to 49 years Women - 893	Population-based study is part of the cluster randomized study	The top five prevalent hr -HPV genotypes were HPV16 (57.1%), 35 (20.3%), 52 (15.8%), 31 (14.1%), and 45 (9.6%)

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47.	Karani, Et Al., 2021	Kenya	HPV – 16 HPV – 18 HPV – 45 HPV – 31 HPV – 33 HPV – 35 HPV – 52 HPV – 58 HPV – 51 HPV – 59 HPV – 39 HPV – 56 HPV – 66 HPV – 68	Women - 289 Age - 18 to 59 years	Cross-sectional study	Characterization of HPV in the current study population showed that HPV type 16 had the highest prevalence of 26 (20.8%) followed by the combination of HPV types (16, 18/45) with 19 (22.6%).
48.	Kabir, Et Al., 2019	Nigeria	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 63	Retrospective Study	Single and multiple HPV infections, the five most frequent high-risk HPVs detected were HPV16 (39.6%), HPV18 (19.8%), HPV45 (12.9%), HPV52 (8.9%) and HPV51 (5.0%)
49.	Song, Et Al., 2020	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 2,300 Age – 19 to 65 years	This study was based on data obtained from a baseline survey of a cohort established during June 2014 to December 2014 in Shanx	The top five HR-HPV genotypes were HPV16 (13.5%), HPV58 (5.7%), HPV52 (4.9%), HPV53 (2.5%), and HPV51 (2.3%). The prevalence of HPV16 and HPV33 increased significantly with the degree of cytological abnormality.
50.	Thistle, Et Al., 2020	Africa	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV - 39, HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV-66 HPV-68 HPV-69 HPV-73 HPV-82	400 participants 30 e 65 anos	Estudo Transversal Prospectivo	Our data also highlighted the representation of hrHPV genotypes other than HPV 16 and 18. These were HPV 35, 45, 52, 58 and 68.

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51.	Zhao, Et Al., 2019	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 9525 Age – 30 to 65 years	Population-based cross-sectional study	HPV52 (21.7%) was the most common HR-HPV genotype, followed by HPV58 (18.2%), HPV53 (18.2%), and HPV16 (16.2 %) . The three main genotypes detected in HR-HPV-positive cervical intraepithelial neoplasia (CIN)1 were HPV16 (36.7%), HPV58 (20.4%), HPV56 (15.3%). Among CIN2+, the most frequent genotypes were HPV16 (75.6%), HPV52 (17.8%), HPV58 (16.7%). HPV16, 56, 58, 53, 52, 59, 68, and 18 combined were assigned to 84.17% of all CIN1 lesions, and HPV16, 58, and 52 combined were assigned to 86.98% of all CIN2 lesions. HPV16, HPV52 and HPV58 were the most dominant high-risk genotypes in this population and attributed to 87.0% of all CIN2+ lesions
52.	Zhou, Et Al., 2021	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV-66 HPV-68	Women - 10,647 Age – 17 to 83 years	Retrospective Study	In this cohort, women with HPV-16 or 18/45+ had a significantly higher immediate risk of cervical cancer and precancer compared to other genotype+ women. The immediate relative risk (IRR) of ASC-H+ was 2.0 (95% CI: 1.9-2.4) and SCC was 9.4 (95% CI: 5.5-15.6) for HPV women -16 or 18/45+ when compared to women positive for 11 other genotypes. Among follow-up biopsy cases, the RIR of CIN2+ was 2.7 (95% CI: 3.0-3.7) and SCC was 10.8 (95% CI: 7.2-17.4) for HPV-16 or 18/45+ women than women positive for other genotypes. Similarly, when compared with women positive for other genotypes, the RIR of CIN2+ was 2.9 (95% CI: 2.7-4.6) and SCC was 13.8 (95% CI: 3.0 -66.2) for HPV-16 or 18/45+ women with ASC-US, and RIR of CIN2+ was 3.3 (95% CI: 3.1-4.6) and SCC was 22.3 (95% CI: 2.8-176.8) for HPV-16 or 18/45+ women with NILM.
53.	Dolou, Et Al., 2021	Africa	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Age – 17 to 61 years Women - 238	Population-based cross-sectional study	The six most common genotypes were HPV 31 (18.7%), HPV 52 (13.82%), HPV 68 (13.01%), HPV 66 (9.76%), HPV 58 (8.13%) and HPV 56 (8.13%). HPV 18 (4.07%) and HPV 16 (0.81%) genotypes were less frequent. The genotypes found in women positive for VIA/VILI are HPV 35, 51, 52, 66. An association of HPV 35 and 52 was observed in the lesions.
54.	Li, Et Al., 2020	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 10,670 Age – 15 to 94 years	Retrospective analysis Population-based study	The most prevalent HR-HPV genotypes were 52, 16, 58, 53, 39 and 51.

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55.	Yan, Et Al., 2020	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 12,165 Age – 30 to 79 years Time - between January 2015 and December 2017	Cervical and vaginal swabs from each patient were collected by gynecologists and tested for HPV DNA using Luminex technology. xMAP	A total of 12,217 individuals were initially considered and a total of 12,165 individuals (mean age, 44.55±7.41 years) were included in subsequent analyses, after which 52 individuals were excluded from further analyzes due to lack of HPV genotype data. The results indicated that the overall prevalence of HPV was 9.34% (1,136/12,165) in the present cohort; 7.41% (901/12,165) of individuals were positive for the high-risk HPV type (HR-HPV) and 1.64% (200/12,165) were positive for multiple types. Among individuals who tested positive for HR HPV types, the three most prevalent types were HPV16 (2.83%), HPV31 (0.99%), and HPV68 (0.88%). Subgroup analysis by age indicated that the highest frequency of HPV infections occurred in individuals aged >60 years. The most common genotype combinations in individuals with multiple types were HPV16 + HPV54, HPV16 + HPV31 and HPV16 + HPV68
56.	Tang, Et Al., 2021	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 82	Women - 12,053 Age – 21 to 60 years or older Time – 1 year	Cross-sectional study	Overall HPV prevalence was 10.16%, and the multiple type infection rate was 1.83%. The HR-HPV infection rate was 8.52%. The six main HPV genotypes were as follows, in descending order: HPV16, HPV58, HPV52, HPV39, HPV51 and HPV53 . Among 52 HPV-positive patients with cervical squamous cell carcinoma, the proportion positive for HPV16 was 61.54%. Among 70 HPV-infected patients with lesions or carcinoma of the cervix, 52 patients were with squamous cell carcinoma of the cervix, and HR-HPV infection occupied 98.57% (69/70). Among the above 52 patients, the other six main genotypes were HPV52, HPV39, HPV51, HPV58, HPV18 and HPV53.
57.	Wang, Et Al., 2020	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 4,332 Age – 26 to 81 years old Time – 7 years	The study was a cross-sectional investigation based on data from women who accepted Thin-prep cytology testing (TCT), HPV testing, and colposcopy	HPV16 and HPV18 were the most common, followed by HPV52 and 58, in all age groups. Among women with normal cytology and HPV infection, 3526(59.97%) women had normal pathology, 1155(19.64%) women had LSIL, 1136(19.32%) had HSIL. The remaining 63 (1.07%) women were diagnosed with cervical cancer, including 17 women with positive HC2-hr-HPV-DNA test results, 31 women with single HPV16 infection, 4 women with HPV 18 infection , 8 women with multiple HPV 16 infections without HPV18, 1 woman with HPV 16 and HPV18 infection, and 2 women with HPV58 infection. HSIL+ detection rates are different between different types of hr -HPV. The rate of HPV16 is the highest (34.00%), followed by HPV31 (27.50%), HPV33 (25.58%), HPV52 (20.77%), HPV35 (17.39%), HPV58 (16.18%), HPV18 (1 2.59%), HPV51 (6.25%), HPV66 (4.88%), HPV45 (4.76%), HPV39 (4.62%), HPV56 (4.69%), HPV68 (4.17%), HPV59 (3.03%), HPV53 (1.28%). Compared to single HPV18 infection, the detection rate of HSIL+ was higher in women with single HPV16/31/33/52 infection, with OR values of 3.576 (95% CI: 2.442– 5.238), 2.633 (95% CI: %: 1.205– 5.753) , 2.386 (95% CI:1.101– 5.172), 1.819 (95% CI:1.096–3.02), respectively. There was no significant difference in HSIL+ detection rates between a single HPV35/39/45/51/56/58/59/66/68 infection and a single HPV18 infection. The detection rate of HSIL+ with a single HPV53 infection was lower than that of HPV18, while the OR value was 0.090 (95% CI: 0.012-0.670).

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58.	Venetianer, Et Al., 2020	USA	HPV – 18 HPV – 39 HPV – 45 HPV – 59 HPV – 16 HPV – 31 HPV – 33 HPV – 35 HPV - 52 HPV – 58	Women - 690 Age – 18 years and over	Biopsy Study Observational study Tissue-based genotyping	Among 689 women in the Biopsy Study with cytological HPV genotyping performed (median age: 26 years; range, 18–67), 276 were diagnosed with CIN2+. Among these, 15 (5.4%) did not test positive for any HPV genotype. hrHPV on cytology, 139 (50.4%) tested positive for a single hrHPV genotype and were attributed to that genotype as causal, and 122 (44.2%) tested positive for multiple hrHPV genotypes on cytology. HPV16 was responsible for 40.4% of hrHPV causation for CIN2+ in white/non-Hispanic women but 23.5% in black women. Conversely, HPV35 was responsible for 8.5% of causal hrHPV in white/non-Hispanic women but 17.6% of causal hrHPV in black women. Our study suggests that although HPV16 is the predominant causal genotype in CIN2+ lesions, it is over-assigned when using the hierarchical model compared to gold standard tissue-based genotyping
59.	Jin, Et Al., 2021	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 940 Time - between January 2019 to December 2019	This study was designed to retrospectively analyze HPV genotype distribution in 940 women with pathologically confirmed SIL and SCC who underwent a biopsy or surgery .	The 5 most common HPV genotypes were HPV16 (35.64%), HPV52 (16.91%), HPV58 (13.94%), HPV33 (8.94%), and HPV18 (7.98%) HPV16 was the most prevalent genotype (21.27%) in LSIL, followed by HPV58 (11.86%), HPV53 (11.25%), and HPV56 (9.61%), while the 5 most prevalent HPV genotypes in HSIL were HPV16 (42.98%). HPV52 (20.79%), HPV58 (16.29%), HPV33 (12.08%) and HPV31 (8.43%). In SCC, the 5 most prevalent HPV genotypes were HPV16 (82.11%), HPV33 (18.95%), HPV58 (15.79%), HPV18 (13.68%) and HPV52 (12.63%) . The prevalence of HPV16 in SCC was significantly higher than in HSIL and LSIL.
60.	Wang, Et Al., 2018	China	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 1,166 Age – average age 42.5 years	Retrospective Study	The 6 most common HR-HPV genotypes were HPV16, 58, 52, 33, 18, and 31 in order. Compared to HR-HPV-negative women, HPV16, 33 or 58 positive women had a higher risk of CIN2+. And women who were infected by multiple types of HR-HPV with HPV16/18 also had a higher risk of CIN2 . Women infected with HPV16, 33, 58 or multiple types of HR-HPV with HPV16/18 are at increased risk of CIN2 .

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61.	Ingabire, Et Al., 2018	Korea	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 4,588 women, of which 1,224 participated in a 2-year follow-up Age - 21 to 66 years	Infection status was assessed using HPV DNA testing (Hybrid Capture 2) and genotyping testing (Linear Array). Data on potential risk factors for HPV infection were collected by trained nurses using structured questionnaires.	Among the 105 baseline HPV infections, only 13 infections (12.4%) remained, and the 10 cases are of the HRHPV type, including genotype 33, 45, 16, 35, and 52. Among the 1,119 women who tested negative at baseline, 54 women (5%) had new HPV infections at follow-up. The HPV genotypes most found in cases of new infection were genotypes 39, 52, 16, 51 and 58.
62.	Najioullah, Et Al., 2021	France	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 70 HPV – 73 HPV – 82	Women - 1,312 Age – 25 to 65 years	Cytological examination of the cervical vaginal smear was performed and classified (Bethesda). HPV DNA detection was performed with the Greiner Bio-one PapilloCheck©Kit	HPV prevalence was 27.6% (297/1075) with a total of 240 (22.3%) women with at least one hrHPV genotype detected. A total of 19.4% (209/1075) of women had hrHPV , 5.3% (57/1075) had lrHPV only , and multiple infections (hrHPV / lrHPV) detected in 31/240 hrHPV cases (12.9%). Among these, 164 had a single viral genotype (68.3%), 51 (21.2%) had 2 genotypes identified and 25 (10.4%) had more than 2 types of hrHPV identified For hrHPV , the most common hrHPV types were HPV51 (11.0%), HPV68 (10.8%), and HPV53 (9.1%), and HPV 52 (7.1%). HPV16 and HPV 18 represented 4.8% and 4.0% of hrHPV genotypes, respectively . Among the 1,075 women in the study cohort, 1 woman developed invasive cervical cancer and 7 women had CIN3.
63.	Wu, Et Al., 2018	China	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 147 Age – 17 to 72 years	Formalin-fixed, paraffin-embedded tissue blocks of cervical neoplasia from 147 patients were obtained from the archives (2014-2016) of the Pathology Department of Shanghai Fifth People's Hospital.	HPV16 (33.3%, 49/147) was the most prevalent genotype in HPV-positive cases, followed by HPV31 (6.1%, 9/147), 52 (6.1%, 9/147), 58 (5.4%, 8/ 147). The other less prevalent genotypes were HPV33, 56, 18, 6, 45, 51, 53, 66, 68, 11, representing 4.1%, 2.7%, 2.0%, 2.0%, 1.4 %, 1.4%, 0.7%, 0.7%, 0.7% and 0.7%, respectively All identified HPV genotypes were detected in cases with LSIL. HR-HPV (16, 18, 31, 33, 52 and 58) were only identified in 95.8% (69/72) of cases with HSIL and SCC.

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64.	Zhang, Et Al., 2020	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 34,587 Age – 25 to 65 years	Retrospective Study All women with altered cytology or a positive result for HPV were referred for colposcopy. A colposcopy-guided biopsy	hrHPV genotype was HPV16 (1373, 32.7%), followed by HPV58 (680, 16.2%), HPV52 (571, 13.6%), HPV53 (504, 12.0%), HPV33 (360, 8.6%) and HPV18 (301 , 7.2%) Of the 204 women with HSIL+, 26 women (26/204, 12.7%) had ICC (24 cases with squamous cervical cancer and two cases with adenocarcinoma), including 14 women (14/26, 53.8%) who were on FIGO IA stage. In the HSIL+ group, the prevalence of hrHPV genotypes was HPV16 (119, 58.3%), HPV52 (28, 13.7%), HPV58 (26, 12.7%), HPV33 (22, 10.8%), HPV31 (15, 7.4 %) and HPV18 (12, 5.9%). The percentage of women infected with multiple hrHPV genotypes was 19.1% (39/204) in the HSIL+ group. In the squamous cervical cancer group, the prevalence of HPV16 (18/24, 75%) was prominent. Of the seven cases of adenocarcinoma in situ and adenocarcinoma, five cases were positive for HPV18 and two cases were positive for HPV16, including one case of dual infection with HPV18 and HPV33 HPV16/18 infection was detected in 129 of 204 (63.2%) women with histological HSIL+; in contrast, the six major hrHPV genotypes (HPV16/18/31/33/52/58) in the HSIL+ group were detected in 190 (190/204, 93.1%) women. However, the colposcopy detection ratio for HSIL+ also increased significantly from 7.7 to 10.2 (P = 0.01). The addition of the HPV31/33 genotype to the HPV16/18 genotype increased the percentage of HSIL+ detection from 63.2 to 77.5% (P =0.002) without significantly increasing colposcopy per HSIL+ detection ratio
65.	Lee, Et Al., 2019	USA	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 698 Age – 21 to 65 years	Recruitment efforts included informational flyers, newspaper articles, and posters at community centers across the reservation. Clinics were established throughout the reservation to accommodate schedules and transportation. After providing informed consent, participants performed vaginal self-sampling using methods identical to those in our previous study in Arizona.	243 women (34.8%; 95% CI, 31.3%–38.5%) tested positive for at least 1 hrHPV . The most prevalent genotypes were HPV-51 (7.6%), HPV-58 (5.3%), HPV-52 (4.3%), HPV-18 (4.3%) and HPV-16 (3 .9%) Even considering regional variations, the genotypic distribution of hrHPV in American Indian women aged 21 to 65 years appears to be distinct from that of the general population. Among American women of all races, HPV-16 and 53 are typically the most prevalent oncogenic types and HPV-18 is one of the least prevalent. 22]. Among tribal women in the present study, however, the most prevalent hrHPV types were HPV-51, 58, and 52, with HPV-18, 16, and 31 close behind (figure 1). Notably, we did not test for HPV-53 because we restricted testing to the 14 hrHPV types included in cervical cancer screening tests. However, this genotype distribution is very similar to what we reported in our Arizona study [26] (which also did not include HPV-53 testing). In both community samples, HPV-51 was the most prevalent oncogenic genotype. An important finding was that HPV-51, which is not covered by any available vaccine, was the most prevalent hrHPV genotype in our sample, at 7.6%. This genotype has a lower prevalence in the general population, but is the most prevalent in at least 2 tribal communities

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66.	Zhang, Et Al., 2019	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 62,883	Cervical cell scrapings were collected with a cytobrush included in the testing kit provided by the company.	The most commonly detected HR-HPV genotypes were HPV52 (5.09%, 3170/62,317), followed by HPV16 (5.06%, 3156/62,317), HPV58 (3.14%, 1959/62,317), HPV53 (2.46%, 1530/62,317), HPV51 (2.07%, 1289/62,317) and HPV68 (2.02%, 1258/62,317) The most commonly detected LR-HPV genotypes were: 2.70% HPV81 (1685/62,317), 1.59% HPV43 (991/62,317), 1.58% HPV42 (986/62,317), 1.54% HPV6 (959 /62,317), 1.15% HPV11 (715/62,317). 0.36% HPV83 (222/62,317).
67.	You, Et Al., 2018	China	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73	Women - 20,017 Age – 21 to 56 years	HRHPV typing using the fluorescence hybridization method Clinically used methods for HPV testing include cytology, immunohistochemistry , spot hybridization, dot hybridization blot , nucleic acid transfer, and polymerase chain reaction (PCR)	The five main types of HR-HPV (indicated in descending order in relation to positivity rate) were HPV16 (21.5%, 169/785), HPV52 (12.2%, 96/785), HPV58 (9.8 %, 77/785), HPV33 (9.7%, 76/785) and HPV18 (7.5%, 59/785) Single-type infection was found in 45.0% (353/785) and multi-type infection in 17.8% (140/785), among which 98 cases had two-type infection, 37 had three-type infection, 2 had infection of four types, 2 had an infection of five types, and 1 case had an infection of six types. The rate of HPV16, -52, -58, -33 and -18 infection was high among patients with cervical cytological changes. Multitype infection increases the risk of malignancies
68.	Ali, Bedair, Abd Elatti., 2019	Kingdom Of Saudi Arabia, Qatar, United Arab Emirates, Bahrain	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 2,478 Age – 25 to 60 years	Cervical samples were subjected to simultaneous liquid-based cytology and HR-HPV DNA analysis.	Of the 2,478 women tested, 520 had positive HR-HPV test results, thus exhibiting an overall HR-HPV prevalence of 21% Other non-HPV16/HPV18 HR-HPV types ranked first among HR-HPV positive cases, representing 63.7% (331 of 520 cases) hpv 16 – 90 cases hpv 18- 14 cases hpv 16/18 – 5 cases Other non-HPV16/HPV18 HR-HPV and HPV16 were the top 2 infections among HR- HPVpositive women who had normal cytology, with a frequency of 64.1% (193 of 301) and 17.9% (54 of 301), respectively. The same trend was observed in HR-HPV-positive women who presented with abnormal cytology, with a prevalence of 63% (138 of 219) and 16.4% (36 of 219), respectively. Among the 2045 women with NILM, the overall prevalence of HR-HPV infection was 14.7% (301 of 2045), P < .001)

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69.	Zhang, Et Al., 2018	China	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 2,612 Age – 18 to 96 years old	Retrospective Analysis HPV genotyping was performed using a flow cytometry fluorescence hybridization method	1, among the types of HPV detected, HR-HPV 16 was the most frequent type (20.6%), followed by HR-HPV 52 (14.4%), HR-HPV 58 (11.0%), HRHPV 18 (8.4%), HR-HPV 53 (5.1%) and HR-HPV 33 (4.3%) HPV 16 (31.3%), 58 (14.1%), 52 (6.1%) and 33 (5.1%) were the most frequent types found in HSIL. In comparison, HPV 52, 16, 58, and 18 caused the majority of LSIL cases with attribution rates of 14.4, 12.1, 7.2, and 4.4%, respectively. , LSIL had a strong relationship with HPV 33 (OR = 5.98, 95% CI = 3.31–10.80), HPV 52 (OR = 3.91, 95% CI = 2.90–5.27) and HPV 16 (OR = 3.65, 95% CI = 2.70–4.95), HPV 58 (OR = 3.188, 95% CI = 2.19–4.63). HSIL was significantly associated with single-type infection with HPV 16 (OR = 9.30, 95% CI = 6.93-12.48), 33 (OR = 7.68, 95% CI = 4.22-14, 0) and 58 (OR = 5.97, 95% CI = 4.18–8.54), 31 (OR = 4.21, 95% CI = 1.18–15.0). The corresponding values for cervical SCC were significantly associated with HPV 16 (OR = 15.39, 95% CI = 9.30–25.44). HR-HPV 52 was the most frequently detected genotype in cases of normal histology (13.6%). HR-HPV 16 (13.5%) and HPV 18 (9.7%) were also the most common types detected in cases of normal histology. In patients with LSIL, HR-HPV 52 was the most frequently detected type (19.3%), followed by HR-HPV 16 (18.2%), HR-HPV 58 (10.9%), and HR-HPV 18 (7.8%). HR-HPV 16 was the most frequently detected type in HSIL (36.7%), and the next most frequent types were HR-HPV 58 (19.3%) and HR-HPV 52 (12.2%). The percentage of patients with HPV 16 detected among the HR-HPV genotypes was 66.1%, and was markedly higher in the cervical SCC group than in the other groups.
70.	Nah, Et Al., 2017	Korea	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 69 HPV – 70 HPV – 73 HPV – 82	Women - 18,815 Age – 20 to 99 years	Retrospective Cross-Sectional Study Undergo cervical cytology testing and HPV genotyping as part of a cervical cancer screening.	The overall prevalence of HPV was 27.8%, with 22.2% HR-HPV and 11.4% LR-HPV. The five most common carcinogens were HPV 52 (3.2%), 58 (2.7%), 16 (2.0%), 56 (1.9%), and 51 (1.8%). The five most common HR- HPVs in normal cytology samples were HPV 53, 68, 70, 52 and 58, while HPV 16, 52, 58, 33 and 31 were prevalent in high-grade squamous intraepithelial lesions (HSIL). In atypical squamous cells of undetermined significance (ASCUS), the prevalence of HR-HPV varied with age; was greater at <0.05).

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71.	Wang, Et Al., 2016	China	HPV – 16 HPV – 35 HPV – 52 HPV – 53 HPV – 58	Women - 2046 Age – 18 to 72 years old	Smears were performed and defined according to the Bethesda classification	Among the 428 cervical samples analyzed in this study, 166 were identified with HPV-positive DNA by consensus primer, 107 cases of inflammation, 19 cases CINI, 9 cases CINII-III and 31 cases of cervical cancer Most common HPV were HPV16 (44.0%, 73/166), 53 (28.9%, 48/166), 52 (25.3%, 42/166), 58 (22.3%, 37/166) and 35 (17.5%, 29/166) Among them, HPV16, 53, 58 and 52 were the dominant types in the inflammation group, HPV16, 53, 52 and 58 were the dominant types in CINI, HPV33 and 53 were the dominant types in CINII-III. In the cervical cancer group, HPV 16, 52, 53 and 58 infection rates were higher. Among the 151 cases, multiple HPV infections were observed in a total of 109 (65.7%) cases, while single HPV infection was found in 42 (25.3%) Among the 108 cases of multiple HPV infections , the proportion gradually decreased with the increasing number of infection genotypes, with 56 cases of double infection, 33 cases of triple infection, 15 cases of quadruple infection, 2 cases of pentagonal infection, and 2 cases of hexagonal infection The distribution of HPV genotypes, especially HR-HPV genotypes, shows diversity in different countries. 17 HRHPV genotypes were found, namely HPV16, 18, 26, 31, 33, 35, 39, 45, 51, 52, 53, 56, 58, 59, 66, 68 and 73. Of the 166 HPV -positive samples, HPV16 (44.0%, 73/166), 53 (28.9%, 48/166), 52 (25.3%, 42/166), 58 (22.3%, 37/166) and 35 (17 .5%, 29 / 166) were the five main genotypes observed in this study. According to the degrees of cervical abnormalities, HPV16, 53, 58 and 52 were the main HPV genotypes in inflammation, CINI and cervical cancer, while HPV33 and 53 were the main ones involved in CINII–III cervical lesions.
72.	Cricca, Et Al., 2015	Italy	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73	Women - 325	Method based on mass spectrometry.	The overall positivity rate by the MS assay was 48% (n = 155/325). Most prevalent types (HPV16, 53, 31, 66 and 52)
73.	Rantshabeng, Et Al., 2019	Africa	HPV – 16 HPV – 18	Women - 185 Age – 38 years (average age)	HPV genetic typing was done using the Abbott RealTime HR-HPV PCR	HSIL (n = 146) and squamous cell carcinoma (n = 39). The prevalence of HPV 16 was 50%, HPV 18 15.2% and other HR-HPV. Hsil was strongly associated with HPV 16.

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74.	Zhang, Et Al., 2017	China	HPV – 16 HPV – 31 HPV – 33 HPV – 52 HPV – 58	Women - 1,664	HPV genotyping and cervical histopathology	Grade 1 (CIN1, 376 cases), grade 2 (CIN2, 408 cases), grade 3 (CIN3, 336 cases), 440 cases of squamous cell carcinoma and 104 cases of adenocarcinoma. HPV16, HPV52, HPV31, HPV58 and HPV33 were the most frequently found.
75.	Zouheir, Et Al., 2016	Morocco	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35	Women - 96	Cervical biopsy.	14 cervicitis, 22 low-grade squamous intraepithelial lesions (LSIL), 36 high-grade squamous intraepithelial lesions (HSIL), and 24 invasive cancers. HPV DNA was detected in 74.0% (71/96) of biopsies. Of these 71 positives, 48 are HPV 16 and 18, 17 cases of HPV 6 and 11 and 6 cases of HPV 31,33 and 35
76.	Fogarasi, Et Al., 2022	Hungary	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 45 HPV – 52 HPV – 58	Women - 4,000 Age – 25 to 65 years	hrHPV) genotyping was performed using the Confidence HPV-X (Neumann Diagnostics) and Linear Array HPV Genotyping (Roche) tests.	446 samples were hrHPV -positive (high risk). Most common HPV16 and 31 and non-vaccine hrHPV (HPV51, 66, 56) unexpected prevalence.
77.	Turner, Et Al., 2017	Honduras	HPV – 16 HPV – 18 HPV – 59 HPV – 68	Women - 802 Age – 40.3 years (average age)	Pap smear; hrHPV genotyping was performed using an hrHPV genotyping assay	Only 104 positive samples. HPV16 presenting the highest infection rate, followed by HPV59 and HPV68. Low prevalence of HPV18.
78.	Wang, Et Al., 2014	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 578 Age – 17 to 79 years	HPV genotyping was detected by flow hybridization and gene chip by HybriMax	257 women were found to be HPV positive for any HPV DNA. Among women with HPV infection, HPV 16 was the most prevalent genotype (53), followed by HPV 52 (45), HPV 6 (40), HPV 11 (34), HPV 42 (29) .
79.	Taskin, Et Al., 2022	Türkiye	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 5,406 Age - 43.87 (average age)	The women's cervical exfoliated cells collected using a specialized cervical brush. Detection of HPV genotypes was tested by real-time polymerase chain reaction (RT-PCR) technology	HPV type 16 was detected in 142 samples, type 18 in 48 samples and other types in 391 samples. Type 16 was highest in the 30 to 39 age group, while type 18 and other types were highest in the 40 to 49 age group.

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80.	Ebisch, Et Al., 2016		HPV – 16 HPV – 18	Women – 520 Age – 33 to 63 years old	Randomized Controlled Self-Sampling Study	HPV 16 and HPV 18 most common.
81.	Liao, Et Al., 2019	China	HPV – 16 HPV – 18 HPV – 52 HPV – 53 HPV – 58	Women - 935 Age – 17 to 77 years	Pap smear and biopsy	806 HSIL and 129 ICC individuals. Most prevalent: HPV16 followed by HPV18.
82.	Thapa, Et Al., 2018	Nepal	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women – 998 Age – 20 to 65 years .	Cross-sectional study of the female population that participated in cervical cancer screening programs and gave permission to collect samples for PCR testing during consultations.	In the study there were 197 (19.7%) cases of positive HPV. High and low risk HPV were 115 (11.5%) and 82 (8.2%) respectively. HPV 16 and HPV 39 were the most common in multiple infections. The most prevalent were the HR-HPV types: HPV16 (6.7%), 39 (4.8%), 58 (2.8%), 33 (2.6%), 51 (1.4%) and 18 (1.2%). HPV 6 (0.65%) was the most common of the LR-HPV. Cytological abnormality was reported in 44 of 998 women. Changes such as LSIL, ASC-US, HSIL, and SCC had HR-HPV infection rates of 25, 13.3, 40, and 75%, respectively.
83.	Wei, Et Al., 2022	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 41,140 Age – 14 to 87 years Time – 5 years	All collected samples were genotyped for HPV using the HPV genotyping test kit (polymerase chain reaction (PCR) + flow-through hybridization.	The results indicate that the overall rate of HPV infection was 18.10% among the data analyzed. The incidence of infections by HR-HPV genotypes was 14.36% (6019/41,926) and infections by LR-HPV genotypes was 2.77% (1,162/41,926) and by both 0.97% (407/41,926). The six most common HR-HPV genotypes were HPV 52, 16, 58, 51, 39 and 53 at overall frequencies of 4.06%, 2.70%, 2.24%, 1.87%, 1.52% and 1.52%, respectively. The most common LR-HPV genotypes were HPV 6 (1.31%), CP8304 (1.01%), and 11 (0.82%).
84.	Kennedy, Ikechukwu, Godd., 2016	Nigeria	HPV – 16 HPV – 18 HPV – 31 HPV – 35	Women - 80 Age – 19 to 62 years	Cross-sectional study carried out between August 2014 and December 2014, at University of Port Harcourt Teaching Hospital. Cervical samples were analyzed for the presence of all possible oncogenic strains of HPV DNA using Real-Time Polymerase Chain Reaction (PCR).	The HPV types detected were 16, 18, 31 and 35. HPV type 18 was responsible for 44% of the HPV genotypes detected, while types 16 and 35 were responsible for 22.2% each and type 31 was responsible for 11%. .

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85.	Wang, Et Al., 2015	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women – 111,131 Age – 15 to 60 years	KingMed database Diagnostics) containing HPV genotyping results.	The total number of positive samples for HR-HPV is 21.07%. The most common infection was HPV16 (18.02%) and HPV52 (16.9%), however, HPV6 (45.80%), HPV11 (26.15%), and HPV61 (14.20%) were more common in LR-HPV. Multiple HPV infections were detected in 486 samples (5.04%), among them 434 (16.82%) and 52 (6.16%) were infected by HR-HPV and LR-HPV, respectively. The most common combinations were HPV16 + HPV52 (26 cases) and HPV52 + HPV58 (14 cases).
86.	Tangjitgamol, Et Al., 2016	Thailand	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women - 4,442 Age – 25 to 65 years	The collected samples were taken to the pathological laboratory of Chulabhorn Hospital for PCR.	Of the total samples, only 279 (6.3%) had abnormal cytopathological results . The rate of HR-HPV is directly related to the severity of the alteration: 5.4% among normal cytology 13.0%, 30.8%, 40.0%, 39.5%, 56.3% and 100.0% among ASC-US, ASC-H, AGC- NOS, LSIL , HSIL, and SCC respectively. The most common types among the 295 HPV-positive women were: HPV 16 (21.7%), HPV 52 (16.3%), HPV 58 (12.9%), and HPV 18 and HPV 51 i (10.5% each). The most common types in women with changes were: HPV 16 (4.7%) and HPV 58 (4.3%) followed by HPV 52, HPV 56, and HPV 66 (4.0% each). However, for women without changes, the most common were: HPV 16 (1.2%) and HPV 52 (0.8%) followed by HPV 18, HPV 51 and HPV 58 (0.6% each).
87.	Harano, Et Al., 2014	Myanmar	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 52 HPV – 58	Women – 1,771 Age – 18 to 69 years old	Study based on the results of samples from consultations at the cervical cancer screening clinic at the Department of Medical Research in Lower Myanmar (DMR-LM).	In this study, HPV testing was performed on 96 women with altered cytology and 20 with normal cervical cytology. Among women with alterations, HR-HPV was detected in 35.5% (22/62) of cases, 60% (6/10) of ASCUS cases, 86.7% (13/15) of LSIL cases, 50% (3/ 6) of HSIL, and 100% (3/3) of carcinoma (SCC). The most prevalent genotypes were: HPV-16 (60.4%) followed by HPV-31 (14.6%), HPV-18 (12.5%) and HPV-58 (12.5%). Genotype 16, 18, 31 and 58 constituted 11 (50%), 2 (9.1%), 5 (22.7%), and 4 (18.2%) of the 22 cases of inflammation on smear and 9 (69.2%), 3 (23.1%), 1 (7.7%), and 0% of the 13 LSIL cases, respectively. HPV16 and 58 were present in 4 (66.7%) and 2 (33.3%) of the 6 ASCUS cases. All cases of HSIL were due to HPV 16. Among women with cervical cancer, 66.7% were due to the HPV 16 genotype and 33.3% were due to HPV 18.

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88.	Salehi-Vaziri , Et Al 2016	Will	HPV – 16 HPV – 18 HPV – 26 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 491 Age – 18 years or older	Cross-sectional study, where cervical samples were obtained. The genomic DNA analysis method was using the QIAamp DNA Mini Kit (Qiagen , Hilden , Germany).	The results demonstrated that 65.8% of samples were negative for intraepithelial lesion or malignancy, 7.3% ASCUS, 11.5% LSIL, 10.1% HSIL and 5.3% CC (cervical cancer). In total, HPV infection was detected in 45.4% of cases. The most common high-risk HPV genotype (HR-HPV) was HPV-16 (32.8%), followed by HPV-53 (9.1%). Within the low-risk genotypes (LR-HPV), HPV-6 (22.2%) and HPV-44 (6.1%) were the most prevalent. HPV-16 was the predominant genotype in cases of cervical cancer (56.5%), ASCUS (34.4%) and HSIL (34.1%). HPV-6 was the most common genotype in normal cases (9.1%) and patients with LSIL (18%). Among cervical lesions, the following genotype distribution follows: single HPV-16 infection, there were 5 patients with ASCUS , 4 LSIL, 13 HSIL and 12 CC (cervical cancer), with co-infection with HPV-16 there were 6 ASCUS, 4 LSIL, 2 HSIL and 1 CC. With a single infection with HPV-18, there was 1 HSIL and 3 CC, while with co-infection with HPV-18 there was only 1 LSIL. Single infection with HPV-31 there was only 1 HSIL, co-infection with HPV-31 3 ASCUS and 2 LSIL. Single HPV-33 infection there was 1 LSIL. Exclusive HPV-35 infection, there was 1 ASCUS and 1 ASCUS co-infection as well. Single HPV-39 infection there were 1 LSIL, 1 HSIL and 1 CC. HPV-39 co-infection there were 2 LSIL, 1 HSIL. Single infection with HPV-45 there was 1 ASCUS and co-infection with HPV-45 2 ASCUS, 1 LSIL, 1 CC. HPV-51 1 ASCUS, 1 HSIL. HPV-51 co-infection 2 ASCUS, 2 LSIL. HPV-52 1 HSIL infection. HPV-52 2 LSIL co-infection. HPV-53 infection 1 ASCUS, 1 LSIL and 2 HSIL. HPV-53 co-infection 2 ASCUS, 4 LSIL, 1 HSIL. HPV-56 infection 2 ASCUS, 1 LSIL. HPV-56 co-infection 4 ASCUS, 4 LSIL. HPV-58 infection 1 ASCUS, 1 CC,. HPV-58 1 LSIL co-infection. HPV-66 infection 1 LSIL, 1 HSIL. HPV-66 co-infection 3 ASCUS. 2 HPV-68 infection 2 LSIL. HPV-68 co-infection 2 ASCUS,1 LSIL. HPV-73 infection 1 ASCUS. HPV-6 infection 4 ASCUS, 2 LSIL, 1 HSIL, 1 CC. HPV-6 co-infection 1 ASCUS, 7 LSIL, 1 CC. HPV-11 co-infection 1 ASCUS, 2 LSIL. HPV-40 1 LSIL co-infection. HPV-44 infection 1 ASCUS. HPV-44 coinfection 1 ASUCS. HPV-54 co-infection 1 ASCUS, 1 LSIL, 1 HSIL. HPV-69/71 co-infection 1 ASCUS, 1 LSIL.
89.	Lazare, Et Al., 2019	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 277 Age – 18 years and over Time – 7 years	Retrospective Analysis	HPV16 was responsible for 21.64% (132/610) of infections, HPV52 for 21.64% (132/610) as well, HPV58 for 15.90% (97/610) and HPV10 for 10.66% (65 /610). Of the cytological changes, among patients with infection by only a single subtype of HR-HPV, 70 had CIN1 and 94 had CIN2+ (CIN2 or CIN3), among patients with type 1 co-infection (simultaneous infection between 2 viruses of the HR-HPV subtypes) 27 had CIN1 and 38 CIN2+, among patients with type 2 co-infection (simultaneous infection with at least one HR-HPV and one LR-HPV virus) 20 had CIN1 and 28 CIN2+. Of those infected with HPV-16, 15 had CIN1 and 35 CIN2+, HPV-52 30 had CIN1 and 19 CIN2+, HPV-58 9 had CIN1 and 18 CIN2+, HPV-33 5 had CIN1 and 17 CIN2+.

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90.	Albawardi, Et Al., 2018	United Arab Emirates	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 75 women Age – 19 to 58 years old Time – 4 years	Biopsies from women diagnosed with cervical squamous intraepithelial neoplasia and recovered cervical carcinomas were analyzed.	The most common types were HPV 16 (49%), HPV 31 (20%) and HPV 18 (6.6%). hrHPV 16 and/or 18 represented 56% and rare subtypes 32%. The incidence of HR-HPV subtypes in cases of HSIL/AIS/Invasive carcinoma are: HPV-16 (49 %) - N=37. HPV-18 (6.6%) N=5. HPV-31 (20%) N=15. HPV-33 (5.3%) N=4. HPV-45 (5.3%) N=4. HPV-52 (5.3%) N=4. HPV-58 (4%) N=4. HPV-68 (2.6%) N=2. HPV-35 (2.6%) N=2. HPV-39 (2.6%) N=2. HPV-66 (2.6%) N=2. HPV-59 (1.3%) N=1. HPV-51 (1.3%) N=1. Negative for HR-HPV (12%) N=9.
91.	Torres-Poveda, Et Al., 2019	Mexico	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women – 115,651 Age – 18 to 89 years old	Program for HPV Screening database and Early Detection of Cervical Cancer registered with Women's Cancer Detection System (SIDECAM).	The percentage of women with at least one high-risk HPV type was 13%, corresponding to 15,040 infected women. The prevalence of infection with non-16/18 HPV alone or with co-infection with HPV 16 or 18 was 10 and 11%, respectively. The association between non-16/18 HPV and cervical squamous intraepithelial lesion has an odds ratio (OD) of 2.17 with a 95% confidence interval (CI) adjusted for age.
92.	Wu, Et Al., 2017	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 8678 Age – 17 to 84 years Time – January 2009 and December 2015	Cervical samples were collected, then HPV DNA was detected and genotyped by " flow-through Hybridization" and "gene chip by HybriMax ".	Of the samples collected, 38.3% were positive for HPV, among them the following prevalence: HPV-16 N=742(22.3%) (N= number of patients), HPV-18 N=216 (6.5%), HPV-31 N=173(5.2%), HPV-33 N =233(6.7%), HPV-35 N=66(2%), HPV-39 N=179 (5.4%), HPV-45 N=41 (1.2%), HPV-51 N =148(4.4%), HPV-52 N=689(20.7%), HPV-56 N=126(3.8%), HPV-58 N=535(16.1%), HPV- 59 N=98(2.9%), HPV-66 N=170(5.1%), HPV-68 N=172(5.2%), HPV-6 N=97(5.9%), HPV-11 N=194(5.8%), HPV-42 N=66(2%), HPV-43 N=36(1.1%), HPV-44 N=38(1.1%), and HPV-CP8304 N=310 (9.3%).

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93.	Chen, Et Al., 2017	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 961,029 Age – 16 to 83 years	Cross-sectional study of cervical samples from women treated at the gynecological outpatient clinic and screened for HPV genotype. In the Zhejiang DiAn laboratory Diagnostics .	The total positive HPV tests during the study were 20.54% (197,367/961,029), and the HR-HPV rate was 16.61% (159,563/961,029). The most common HR-HPV types were HPV16 (17.64%), HPV52 (16.35%), and HPV58 (15.80%), and the most common LR-HPV types were HPV11 (5.61%), HPV6 (5.60%) and HPV42 (4.03%). Of the 44,361 multiple positive HPV cases, three genotypes had higher positivity rates: HPV16 (25.95%), HPV52 (21.75%), and HPV58 (21.75%) (Fig. 2). The most common genotype combinations were HPV16+HPV58 (n=1214), HPV16+HPV18 (n=1116), HPV16+HPV 52 (n=1025). The percentage of abnormal cytology was different between HP-HPV types, such as 34.01% in HPV 16, followed by HPV 33 (31.08%) and HPV 58 (30.53%). Furthermore, HR-HPV types represented a larger portion in the ASC-US cytology group (64.03% vs. 7.94%), LSIL (80.04% vs. 9.70%), and LSIL (91. 06% vs. 2.37%) than LR-HPV. HPV16 and HPV58 were the main genotypes in ASC-US, LSIL, or HSIL, followed by HPV 52 in ASC-US and LSIL, and HPV 33 in LSIL. HPV 52, 16 and 58 were the most common in normal cytology. The odds ratios (OR) of developing malignant changes in the HR-HPV and LR-HPV and HPV-negative groups were 12.56, 3.21 and 0.06, respectively. Among the genotypes, HPV 16 had the highest OR (6.99), followed by HPV 58 (5.80), 33 (5.65), and 66 (5.21).
94.	Oštrbenk Valenčak, Et Al., 2019	Slovenia	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 4,510 Age – 20 to 64 years Time – 5 years	Digene HR-HPV DNA Assay Hybrid Capture 2 (hc2; Qiagen , Gaithersburg , MD, USA) and the Abbott RealTime HR-HPV assay (RealTime ; Abbott, Wiesbaden, Germany. Samples were stored in ThinPrep solution PreservCyt (Hologic , Marlborough , MA, USA). After 36 months, participants from the initial screening were invited to the second round of screening, using a similar approach, between December 2012 and October 2014.	The overall prevalence of hrHPV infection , regardless of HPV genotype, was 9.6%. Results from the first and second rounds of screening identified 68 and 36 CIN2+ cases, respectively. the risk of CIN2+ was significantly higher for HPV16 and HPV16/18-positive women than for non-type 16/18 hrHPV -positive women.
95.	Martins, Et Al., 2016	Brazil	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 70 HPV – 73 HPV – 82	Women - 403 Age – 14 to 95 years	Study of collected samples.	The cytological diagnosis showed 75% of women with NILM, and those with abnormalities presented: 54 (8.1%) ASCUS; 66 (9.9%) LSIL; 43 (6.5%) HSIL and 3 (0.5%) ICC. The most common HPV type was 16 (23.2%), followed by 56 (21.0%), 52 (8.7%), 31 (7.7%), 53 (7.7%), 51 (7.4%), 39, 59 and 66 (6.5 % each), 33 (5.3 %), 58 (5 %), 18 (5 %), 82 (4 %), 45 and 70 (4 % each), 68 (3.4 %), 73 (2.5 %) and 35 (2.5%). The frequency of LR-HPV were 42 (12.1 %), 6 (6.2 %), 44 (4.3 %), 43 (4 %), 40 (2.8 %) and 11 (1.5 %). In cases of LSIL the most common was HPV 56 with 28.8% (19/66). While for HSIL and ICC, HPV 16 was the most prevalent with 37.2% (16/43) of cases and 66.7% (2/3) of samples where the third showed HPV33.

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96.	Wolday, Et Al., 2018	Ethiopia	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women - 233 Age – 18 years and over	The clinical examination consisted of collecting two cervical samples, one for routine cytopathological examination and the other for HPV detection by PCR.	Of the 233 participants, 134 had high-risk HPV, with HPV16 (44.1%) being the most prevalent, followed by HPV35 and HPV45 (each 6.2%), HPV31 (4.4%), HPV56 (3.7%), HPV18 and HPV59 (each 3.1%), HPV58 (2.5%), HPV39 (1.9%) and HPV52 (1.2%). Of the participants with abnormal cytological changes, the most common infection was HPV16 (62%), followed by HPV45 (8.7%), HPV 31, HPV35 and HPV59 (Each 4.4%), and HPV 18, HPV52 and HPV56 (Each 2.2%) . The most common HPV with LSIL was HPV16 (66.7%) and HPV45 (16.7%); In HSIL it was HPV16 (63.5%), HPV31, HPV45 and HPV59 (each 6.4%), HPV35 (4.8%), HPV18 (3.2%) and HPV56 (1.6%). In ICC Lesions it was HPV16 (56.5%), HPV45 (13%), HPV52 (8.7%) and HPV35 and HPV56 (each 4.4%).
97.	Martínez, Et Al., 2016	Mexico	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women – 700 Age – 15 to 82 years old.	Collection of two cervical samples, one for cytopathology and the other for HPV testing by PCR.	67.6% of the Participants had HPV infection, 52% with just one type and 48% with multiple types. The most prevalent HR-HPV was HPV33 (33.1%, HPV16 (16.6%), HPV18 (6.7%) and HPV51 (6.7%). The LR-HPV types were HPV6/11 (8.3%), HPV43 (7.9%) and HPV66 (5.3%). In LSIL the most prevalent type of HR-HPV was HPV33 (39.5%) and HPV16 (14.9%). In HSIL it was HPV16 (20.3%), followed by HPV33 (16.3%) and HPV39 (11.5%). % In CC it was HPV16 (47.6 %), HPV33 (38.1 %) and HPV39 (19.0 %). The most prevalent type of LR-HPV in LSIL was HPV43 (7.8 %), HPV6/11 (7.2 %) and HPV66 (4.9%); In HSIL they were HPV6/11 (13.5%) and HPV43 = HPV66 (7.4%); And in CC they were HPV6/11 (14.3%) and HPV43 = HPV44 (9.5%).
98.	Jiang, Et Al., 2019	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 56 HPV – 68	Women – 94,640 Age – 21 to 60 years	Jinan database KingMed Diagnostics (JDK) containing HPV genotyping results from samples collected and tests performed at JKD Genetics Laboratory .	Of the samples collected, only 94,489 (99.8%) were positive for HPV. The most common high-risk type (HR-HPV) detected was HPV16 (5.8%), followed by HPV52 (5.1%), HPV58 (3.5%), HPV51 (2.6%), and HPV56 (2.3%). In LR-HPV, HPV81 (2.8%), HPV53 (2.8%), and HPV6 (2.3%) were the most common.
99.	Beyazit, Et Al., 2018	Türkiye	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 73 HPV – 82	Women - 201 Age – 42 years old (average age)	Retrospective Papanicolaou study Patients' cervical smears were classified using the Bethesda system and HPV analyzes were performed using the polymerase chain reaction (PCR) method.	The most common HPV types identified were HPV58, HPV16, HPV31, HPV33, HPV11 and HPV35.

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100.	Chiappetta, Et Al., 2015	Italy	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59	Women – 33 Age – 35 to 64 years	Exfoliated cervical cells were collected using a cytobrush	The most frequent genotype detected was HPV 16, identified in 16/33 (48.5%) at baseline and 8/22 (36.4%) women positive for hr -HPV at 1 year (Figure 2); Among the 8 HPV16-positive women in the 1-year recall, 50% (4/8) had histological lesions (3 CIN1 and 1 CIN2+). HPV18 was observed in 8/33 (24%) and 4/22 (18%) women at baseline and 1-year hr -HPV+ recall, respectively; In any case, we did not observe a histological lesion. Furthermore, we identified at baseline 6/33 (18%) co-infection of HPV 16 with another HPV type (HPV 18, 31, 70); o 66.7% (4/6) of these co-infections were due to HPV16 with HPV18 (Table 2). At the 1-year recall, only 1 co-infection (HPV16/70) persisted without showing histological signs while a woman with HPV16/18 co-infection at baseline and only HPV 16 infection at the 1-year follow-up developed a CIN2+ lesion.
101.	Rudolph, Et Al., 2016	Mexico	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 30,829 Age – 30 to 64 years	We studied specimens and data from the FRIDA study, a population-based demonstration project. Pelvic examination during which a cervical sample was collected using a Cervex-Brush ® (Rovers®).	Among all age groups, 9.0% tested positive only for non-16/18h HPV. By age group, HPV16/18 prevalence was higher for the youngest women in the population at 2.9% (95% CI 2.5–3.3) for ages 30–34 and 2.3% (95% CI 2.0–2.7) for ages 35–39.
102.	Tian, Et Al., 2017	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 52 HPV – 58	Women - 461	Pap smear Colposcopy	In the present study, the highest rates of cervical cancer were identified in women infected with hrHPV types HPV-16/18 (81%), HPV-58 (4.3%), HPV-52 (4.3%), HPV -31 (4.3%) and HPV -33 (1.4%), with other types of hrHPV making up a further 4.3%. HPV types 52/58/31/33 represented 16.7% and 14.3% of cervical cancer diagnoses in the meta-analysis data and in our study, respectively
103.	Persson, Et Al., 2015	Sweden	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women - 326 Age – 29 to 50 years	Prospective cohort study	Overall, 214 (68.2%) women were positive for any of the 13 high-risk (HR) HPV types defined as oncogenic by the International Agency for Research on Cancer. 13] , but the majority of infections were due to HPV types 16 and/or 18 (27.7%). Sixty-six women (21.0%) were HPV 16 positive and 27 (8.6%) HPV 18 positive. Of the 66 women positive for HPV 16, 8 (12.2%) were ASCUS and 58 (87.9%) were LSIL and of the 27 women positive for HPV 18, 4 (14.8%) were ASCUS and 23 (85. 2%) were LSIL. The second most common type of HPV in the group was HPV 51 (10.8%)
104.	Ikesu, Et Al., 2022	Japan	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women – 729	Cohort study histological sampling by colposcopy	Compared to lesions in patients with other HPV genotypes, lesions in HPV 16-positive patients were estimated to be more likely to increase in severity (i.e., CIN3/cancer); over 2 years, 17.7% (95% confidence interval [CI], 9.3%–29.3%) and 27.8% (95% CI, 16.6%–43.5%) of those with HPV 16 progressed to CIN3/cancer from the true CIN1 and CIN2 states, respectively, whereas 55% to 70% of CIN1/2 patients infected with HPV 52/58 remained in the CIN1/2 category

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105.	Ozturk, Et Al., 2020	Türkiye	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 249	Liquid-based cervical smears and HPV screening colposcopic cervical biopsy .	In this study, HPV 16 was the most common genotype in high- and low-grade lesions. In patients with high-grade lesions, HPV 31 and HPV 18 were the second and third most common. For low-grade lesions, HPV 51 was the second most common (28.9%) and its frequency was significantly higher compared to patients with high-grade lesions (6.6%).
106.	Paengchit, Et Al., 2014	Thailand	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 2,000 Age – 30 to 70 years	Vaginal smear liquid cytology and HR-HPV test	The most common genotype was HPV 52 (17.6%), followed by HPV 16 (14.81%), HPV 58 (13.89%), HPV 33 (11.11%). HPV 51 (11.11%) and HPV 56 (9.26%). HPV 18 was found in only 5.6% of cases. Together, HPV 16/18 were observed in approximately 20.4% of cases. Eighteen (16.67%) women were positive with multiple subtypes of HR-HPV. Co -infection most frequently involved HPV 16 or HPV 58.
107.	Marks, Et Al., 2015	Thailand	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 73 HPV – 82	Women - 1256 Age – 20 to 37 years	Cervical smear prospective study investigating	Overall 307 (24.6%) and 175 (14.0%) of women were positive for any HPV type and any HR-HPV type, respectively; the most common types were 72, 52, 62, and 16. Among women diagnosed with CIN 2/3 at enrollment (n = 11), the most prevalent HPV types were 52 and 16 .
108.	Wang, Et Al., 2019	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 51 HPV – 52 HPV – 53 HPV – 58 HPV – 66	Women - 37722 Age – 13 to 89 years	Pap smear	The 10 most common genotypes of HPV infection were as follows: HPV 16 (1462, 3.79%), HPV 52 (953, 2.47%), HPV 58 (680, 1.76%), HPV 53 (520 , 1.35%), HPV 31 (276, 0.72%), HPV 39 (264, 0.69%), HPV 33 (254, 0.66%), HPV 81 (253, 0.66%) , HPV 18 (249, 0.65%) and HPV 66 (249, 0.65%). Notably, HPV 16 was the most common genotype among all patients. Furthermore, HPV 16, 52 and 58 were the three main prevalent genotypes among HR-HPV

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109.	Xu, Et Al., 2016	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 19,207 Age – 16 to 89 years	Population-based prospective observational study. hrHPV screening results referred directly for colposcopy biopsy	Overall, HPV52 was the most prevalent genotype (4.9%), alone or in combination with other types, followed by 16 (3.1%), 58 (2.7%), 39 (1.6%) , 18 (1.5%), 56 (1.5%) For patients with cervicitis /CIN1, HPV52 was the most common HPV type with a prevalence of 27.0%, followed by 58 (15.5%), 16 (14.4%), 39 (9.4%) , 56 (9.0%) and 18 (8.4%). For patients with CIN2+, HPV16 was the most common HPV type with a prevalence of 43.3%, followed by 58 (19.4%), 52 (19.1%), 33 (13.5%), 31 (7.5%) and 18 (5.6%). HPV16, 52 and 58 were the three types of HPV most commonly found in any state of cervical pathology. Notably, HPV52 was the most common type among women with /CIN1 cervicitis , but the distribution notably changed to CIN2+, where it ranked third.
110.	Khunamornpong, Et Al., 2016	Thailand	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women - 5433 Age – 25 to 65 years	Pap test and HPV test (Hybrid Capture 2) women who had positive cytology or positive HC2 were referred for colposcopy with cervical biopsy.	HPV52, HPV16, HPV58 and HPV31 were the most common genotypes in 56 women with histological HSIL+, whether in the single infection group or combined single and multiple infections. The percentage of histological HSIL+ detection was greater than 20% for HPV58 (44.4%), HPV16 (33.3%), HPV52 (24.5%), HPV33 (25.0%) and HPV31 (23.8%). %), but HPV33 was detected in only a few samples. HPV16, HPV18, HPV31, HPV52, and HPV58 were detected in 51 of 56 (91.1%) women with histological HSIL+.
111.	Guo, Et Al., 2019	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 66 HPV – 68	Women - 3997 Age – 21 to 64 years	Women with ASCUS cytology underwent punch biopsy and endocervical colposcopy/curettage.	Among ASCUS women with a CIN2 lesion, HPV prevalence was 40.0% (type 16), 10.0% (type 18), 0.0% (type 33), 30.0% (type 52) , 40.0% (type 58) and 30.0% (nine other types). For ASCUS women with CIN3 lesion, HPV prevalence was 68.4% (type 16), 15.8% (type 18), 10.5% (type 33), 31.6% (type 52), 15 .8% (type 58) and 36.8% (other nine types). Prevalence of HPV 16, HPV18, HPV 33, HPV 52, HPV 58 in samples from ASCUS patients with CIN3 lesion was 68, 16, 11, 32 and 16%, respectively. These findings indicate that women with ASCUS and HPV 16, 18, 33, 52 or 58 infections may present with high-grade CIN.

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112.	Shen-Gunther, Et Al., 2016	Usa	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68	Women - 277 Age – 18 years or older	Prospective cross-sectional study used residual liquid cytology samples for HPV genotyping and epigenetic analysis	The types of HR - HPV 16, 18, 31, 33, 35, 39, 45, 51, 52, 56, 58, 59 and 68.
113.	Othman, Et Al., 2014	Malaysia	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 68 HPV – 73 HPV – 82	Women - 635 Age – 43 years old (average age)	Cervical scrapings were collected from women attending clinics for routine Pap smears .	HPV-16 was by far the most prevalent genotype, 57.1 % (12/21) of all HPVs , representing 1.9% (12/635) of the total samples, followed by HPV-58 (19.0% ; 4/21); and HPV-6 (9.5%; 2/21). There were equal incidences of HPV-18, 33 and 61 (4.8%; 1/21) .
114.	Baloch, Et Al., 2016	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66	Women - 17,898 Age - 18 to 93 years	Pap smear Polymerase chain reaction was used to detect HPV-positive samples and HPV genotyping array testing was used for genotyping.	The most common HPV genotypes were HPV-52, 16, 58, 53 in the control group, HPV-16, 52, 58, 39 and 53 in CINI (Cervical Intraepithelial Neoplasia), HPV-52, 16, 58, 33, 53 and 81 in CINII, HPV16, 58, 18, 52, 81 in CINIII and HPV-16 18, 58, 52 in cervical cancer (CC), respectively. In this study, three PHR-HPV genotypes (HPV-53, 66 and 81) were also detected and were highly prevalent in CIN1 and CIN2 samples. Only three CC samples showed co-infection with the HPV-66 and HR-HPV genotypes. Interestingly, eight single and multiple LR-HPV infections were detected in the normal and abnormal cytology groups. Some of the unclassified HPV genotypes, such as HPV-67, 69, 70, 71, 82 and 83, were also found in the control group. Of the 17,898 women, 16,968 (94.8%) were normal, 458 had CIN1, 247 had CIN2, 181 had CIN3.
115.	Andralojc, Et Al., 2022	Netherlands	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73	Women - 610	Cervical smear	As expected, HPV16 constitutes the majority of infections and was most associated with high-grade CIN. In this cohort, hrHPV 45/56/66/68 genotypes were underrepresented in CIN2+ relative to groups without CIN/CIN1. In 72/298 hrHPV RNA positives (24%), multiple hrHPV genotypes were detected

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116.	Kantathavorn, Et Al., 2015	Thailand	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 69	Women - 5,906 Age – 20 to 70 years	Samples were obtained using a cytobrush	Overall prevalence of HPV among 5,906 Thai women was 15.1%, with 6.4% high risk (HR), 3.5% probable high risk (PR), and 8.4% low risk (LR) of HPV. Overall, the most frequent HR-HPV types consisted of HPV52 (1.6%), HPV16 (1.4%), HPV51 (0.9%), HPV58 (0.8%), HPV18 (0.6 %) and HPV39 (0.6%). The common types of PR-HPV were HPV70 (1.0%), HPV66 (0.8%), HPV53 (0.8%), and HPV68 (0.6%). The LR-HPV subtypes were HPV72 (2.5%), HPV62 (1.7%), HPV84 (1.1%), HPV71 (1.0%), and HPV61 (0.6%).
117.	Lorenzi, Et Al., 2019	Brazil	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 73 HPV – 82	Women - 3,079 Age – 18 years or older	Pap smear Retrospective assessment	Of the 443 samples available for analysis, high-risk HPV was detected in 369 samples, 72 were positive for high- and low-risk HPV simultaneously, and 2 cases tested positive for low-risk HPV. HPV -56 and HPV-51 were the most common types, being detected in 32.3% and 31.4% of samples, respectively. This represents 3.7% of the prevalence of HPV, considering the percentage of HPV-positive women found in this study (11.5%). After HPV-53 (20.5%), HPV-18 (18.5%), HPV-58 (17.6%), HPV-52 (16.0%) and HPV-16 (6%) were the most frequent, which represents a prevalence of 2.35%, 2.12%, 2.02%, 1.84% and 1.80%, respectively, according to the percentage of women with HPV positive studied.
118.	Wang, Et Al., 2015	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 53 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68 HPV – 69	Women - 326	We compared results with the CervicGen HPV RT- qDx assay	The overall HPV prevalences determined by HPV DNA and HPV E6/E7 mRNA assays in this study were 79.9% (259/324) and 55.6% (180/324), respectively. Although HPV E6/E7 mRNA expression positivity was significantly lower than HPV DNA positivity, the HPV E6/E7 mRNA assay showed higher specificity than the HPV DNA assay (88.6% vs. 48.1%) in normal cytology samples. The prevalence of Alpha-9 (HPV 16, 31, 33, 35, 52, and 58) HPV infection among these women accounted for up to 80.3% and 76.1% of high-grade lesions detected in testing. HPV mRNA and DNA, respectively. The distribution of the HR-HPV genotype, based on HPV DNA and E6/E7 mRNA expression by age group in patients with cytologically confirmed lesions, was higher in women aged between 40 and 49 years (35.9% for cytologically confirmed cases, Pearson correlation value r = 0.993 , p

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119.	Zhang, Et Al., 2018	China	HPV – 16 HPV – 18	Women - 1,916 Age – 25 years and over	Colposcopy	The distribution of infection by HPV16, HPV18 and other HR- HPVs was 49.22%, 9.45% and 41.33%, respectively. 71.56% had normal cervical histology, 7.05% had Cervical Intraepithelial Neoplasia1, 8.82% had CIN2, 7.25% had CIN3, and 5.32% had cervical cancer. The percentage of HPV16 and HPV18 positivity was highly associated with the relative risk of cervical injury. The sensitivity and specificity of HPV16/18 for detecting CIN2+ (CIN3+) was 82.68% (92.12%) and 47.87% (46.15%), respectively. The positive predictive value and negative predictive value of HPV16/18 for detection of CIN2+ (CIN3+) were 30.16% (19.75%) and 91.03% (97.60%), respectively. HPV16 and HVP18 are the most common genotypes in high-grade cervical lesions in Shaan'xi Province
120.	Correa, Et Al., 2022	Argentina, Colombia, Paraguay, Honduras, Costa Rica, Uruguay	HPV – 16	Age – 30 to 64 years	Colposcopy and Pap smear	HPV16 was by far the most frequently detected type
121.	Guo, Et Al., 2022	China	HPV – 16 HPV – 18 HPV – 31 HPV – 33 HPV – 35 HPV – 39 HPV – 45 HPV – 51 HPV – 52 HPV – 56 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 3,332 Age – 30 to 59 years	Multicenter, Cross-sectional, Population-Based Cervical Cancer Screening Trial self-collected cervical-vaginal sample .	The overall prevalence of Hr -HPV was 18.7% (95% CI 17.4–20.1%) for self-collected HPV testing , with the most prevalent genotypes being HPV-16 (3.8%), – 31 (2.6%) – 58 (2.3%), –18 (2.1%) and –52 (2.0%).
122.	Senapati, Et Al., 2017	India	HPV – 16 HPV – 18 HPV – 39 HPV – 45 HPV – 51 HPV – 58 HPV – 59 HPV – 66 HPV – 68	Women - 607 Age – 18 years or older	swab sample was collected using cytobrushss	595 samples were analyzed for cytology and HPV PCR. Only 346 cases were considered positive for HPV. Of these, 172 were confirmed cases of cervical cancer and 174 with normal cytology presenting minor gynecological symptoms such as abnormal discharge, bleeding and pain during intercourse, lower abdominal pain, intermenstrual bleeding considered controls in the study. The detected genotypes were HPV16,18,51,39,66,68,45,35,6/11,58 ,43 and 42. The prevalence of multiple genotypes was 23.41% with double, triple and quadruple genotypes while the prevalence of single infection genotypes was 76.59%

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Table S2: Assessment of articles on the most oncogenic HPV subtypes (QUIPS tool).

		Participation in the study	Friction between studies	Prognostic factor measurement	Measurement of results	Confounding bias across studies	Statistical analysis and results	General
1		+/-	?	+	+	?	+/-	+/-
2		+	?	-	+	?	+	+
3		+/-	?	-	+	?	+	+
4		+/-	?	+	+	-	+	+
5		+	?	+	+	-	+	+
6		+/-	?	-	+	?	+	+/-
7		+	?	-	+	-	+	+
8		+/-	?	+	+	-	+	+
9		-	?	-	+	-	+	+/-
10		+/-	?		+	-	+	+
11		+/-	?	-	+	-	+/-	+/-
12		+/-	?	-	+	-	+/-	+/-
13		+	?	-	+	+	+	+
14		+	?	-	+	-	-	+/-
15		+	?	-	+	-	+	+
16		+	?	+	+	-	+	+
17		+/-	?	+	+	-	+	+
18		+	?	+	+	-	+	+
19		+/-	?	-	+	-	+	+/-
20		+	?	-	+	-	+/-	+/-
21		+/-	?	+	+	-	+/-	+
22		+	?	+	+	-	+/-	+
22		+/-	?	+	+	-	+	+
23		+	?	+	+/-	-	+	+
24		+/-	?	+	+	-	+	+/-
25		-	?	+	+	-	+	+
26		+/-	?	+	+	+	+	+
27		-	?	+	-	+	+	+
28		-	?	-	+	+	+	+/-
29		+	?	-	+	-	+	+
30		+	?	-	+	+	+	+
31		+/-	?	-	+	+	?	+
32		+/-	?	-	+	+	-	+/-
33		+	?	-	+	+	?	+/-
34		+/-	?	-	+	-	+	+/-
35		+/-	?	-	+	-	+	+
36		+	?	-	+	-	+	+
37		+	?	-	+	+	+	+
38		+/-	?	-	+/-	+	-	+/-

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39		+	?	-	+	-	+	+
40		+	?	-	+	-	-	+/-
41		+	?	+	+	+	+	+
42		+/-	?	-	+	-	+	+/-
43		+/-	?	-	+	-	+/-	+/-
44		+/-	?	+	+	+	+/-	+
45		+	?	+	-	-	+	+
46		+/-	?	-	+/-	-	+/-	+/-
47		+/-	?	-	+	+/-	-	+/-
48		+	?	-	+	-	+	+/-
49		+	?	-	+	+	-	+
50		+/-	?	-	+	-	+/-	+/-
51		+	?	-	+/-	-	+	+
52		+	?	-	-	-	+	+
53		+	?	-	+	+	+/-	+
54		+	?	-	+	-	+	+
55		+	?	-	-	-	+	+
56		+	?	-	+	-	+	+
57		+	?	-	+	-	+/-	+
58		+/-	?	-	+/-	-	+/-	+/-
59		+/-	?	-	+	-	+	+
60		+/-	?	-	+	-	+	+
61		+	?	-	+	-	+/-	+
62		+/-	?	-	+	-	+/-	+/-
63		-	?	-	+/-	-	+	+/-
64		+	?	-	+	+/-	+	+
65		+/-	?	-	+	-	+	+
66		+	?	-	+/-	-	+	+
67		+	?	-	+	-	+	+
68		+/-	?	-	+/-	-	+	+/-
69		+/-	?	-	+/-	-	+	+/-
70		+	?	-	+	-	+	+
71		+/-	?	-	-	-	+/-	+
72		+	?	-	-	-	+/-	+
73		+	?	+	+	+	+	+
74		+/-	?	+	+	+	+/-	+
75		+	?	+	+	+	+	+
76		+	?	-	+/-	+	+	+
77		+	?	-	+/-	-	+/-	+/-
78		+	?	-	+/-	-	+	+/-
79		+	?	-	-	-	+	+/-
80		+	?	+	+	+	+	+
81		+/-	?	-	+/-	-	-	+/-
82		+/-	?	-	+	-	`+	+
83		+	?	-	+	-	+	+
84		+	?	-	+/-	-	-	+/-

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85		+	?	-	+	-	+	+
86		+	?	-	+/-	-	+	+
87		+/-	?	-	-	-	+/-	+/-
88		+	?	-	+/-	-	+	+/-
89		+	?	-	+/-	-	+/-	+/-
90		+/-	?	+/-	+/-	+/-	+/-	+/-
91		+	?	-	+/-	-	+/-	+/-
92		+	?	-	+/-	-	+	+
93		+	?	-	+	-	+	+
94		+	?	-	+/-	-	+	+
95		+	?	-	+/-	-	+/-	+/-
96		+	?	-	+/-	-	+	+
97		+	?	-	+	-	+/-	+/-
98		+	?	-	+/-	-	+/-	+
99		+	?	-	+/-	-	+	+/-
100		+	?	-	+	-	+	+/-
101		+	-	-	+/-	-	+	+
102		+	?	-	+/-	-	+/-	+/-
103		+	?	-	+/-	-	+/-	+/-
104		+	?	-	+/-	-	+/-	+/-
105		+	?	-	+/-	-	+	+/-
106		+	?	+	+	-	+/-	+
107		+/-	?	-	+	-	+/-	+
108		+	?	-	+	-	+/-	+
109		+	?	-	+	+	+	+
110		+	?	-	-	+/-	+	+
111		+	?	-	-	+/-	+/-	+/-
112		+	?	-	-	+/-	-	+/-
113		+	?	+	+	+	+/-	+
114		+	?	-	+/-	+/-	+	+/-
115		+	?	-	+/-	+	+	+
116		+	?	-	-	+	+	+
117		+	?	-	-	+/-	+	+
118		+	?	-	+	+	+/-	+
119		+/-	-	-	-	-	+/-	+
120		+	?	-	-	-	-	+
121		+	?	-	-	+/-	+/-	+/-
122		+	?	+	-	+	+/-	+

(+) High Quality, (+/-) Acceptable, (-) Low Quality, (?) Unsafe.

Source: The Authors (2022).

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